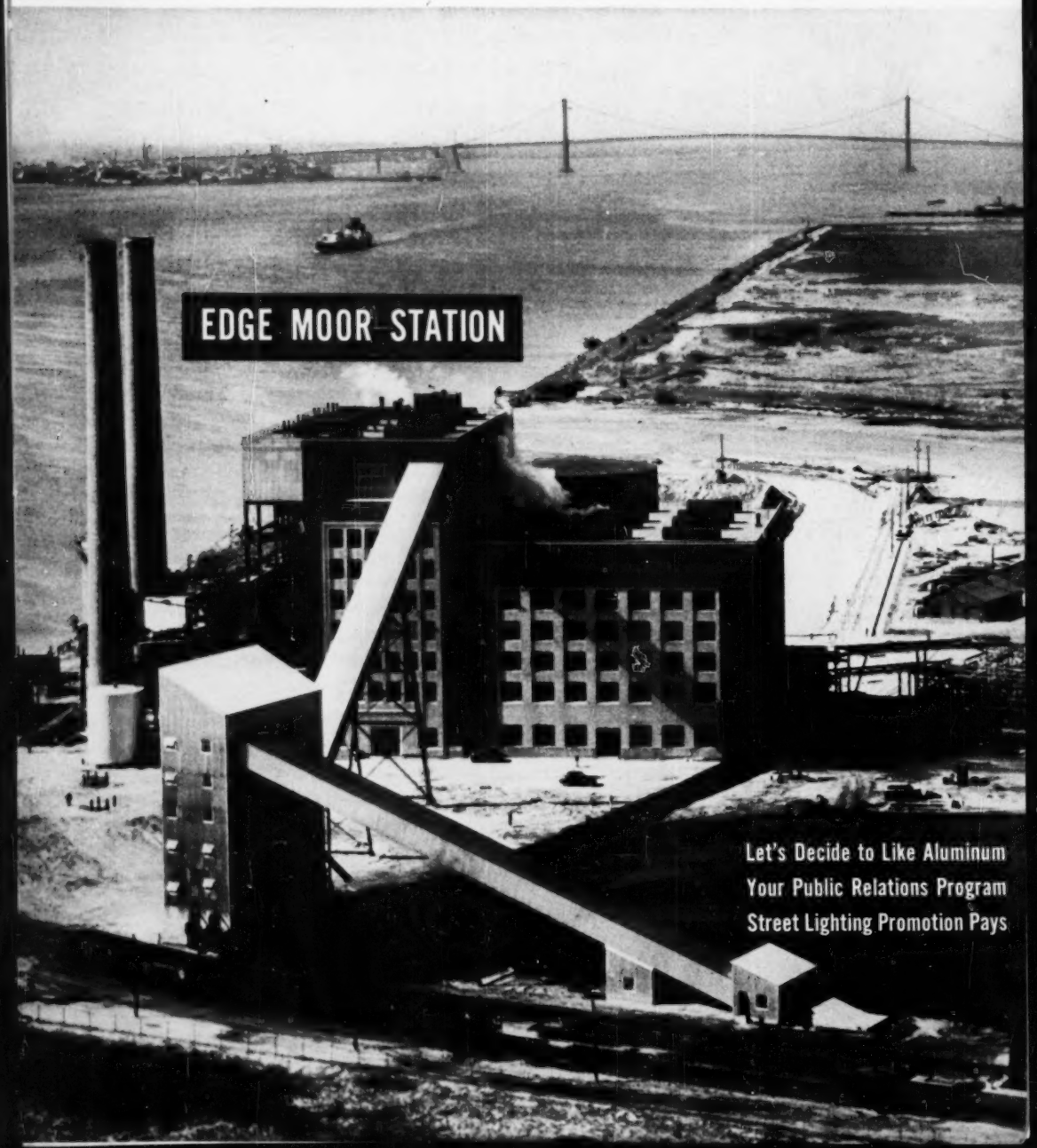
JANUARY 14, 1952

Electrical World

Price 35 Cents

A McGRAW-HILL PUBLICATION



Let's Decide to Like Aluminum

Your Public Relations Program

Street Lighting Promotion Pays

NEW CHANGE IN FEDERAL SPECIFICATION W-P-131a COVERING AUTOMATIC CIRCUIT BREAKERS

Important to those who specify, sell, buy or install circuit breaker panelboards is amendment-2 to Federal Specification W-P-131a. The amendment creates new classifications for circuit breakers. Circuit breakers of 5000 ampere interrupting capacity, for instance, are now classed as follows:

Single unit, single pole, 15-100 ampere, 120 volt AC-Class A-1.

Multiple unit, single pole, 15-50 ampere, 120 volt AC-Class B-1.

Single unit, single pole, 15-100 ampere, 125 volts DC, 120 volts AC-Class C-1.

This change means that single pole fully magnetic circuit breakers may be specified and purchased under these new classifications.

Fully Magnetic Circuit Breakers incorporate many advantages which warrant study by electrical contractors, plant engineers, consultants, and others interested in dependable electrical systems.

Among the advantages of Fully Magnetic Circuit Breakers are:

1. They require the least amount of engineering time to properly select and apply. Because they operate on magnetism — not heat — no "derating" is necessary. Inasmuch as fully magnetic circuit breakers always carry the full load, regardless of temperature, the proper selection of the breaker is based only on the load they must carry.
2. Fully magnetic circuit breakers can be installed in a boiler room, near ovens, soldering pots, radiators, steam pipes or in direct sunlight with the only consideration being the use of the proper size insulated wire and wiring procedure as set forth by the National Electrical Code. Because they depend on magnetic action alone for their tripping action, there is no possibility of nuisance tripping due to any external source of heat or from internal heat built up in panelboards.
3. Fully magnetic circuit breakers can be reset quickly. Because their action is magnetic, no elements in the breaker have heated up to cause the tripping. After tripping magnetically, the breakers can be reset in a matter of seconds after the trouble has been removed. There is no waiting period for "cooling off."

These performance advantages of fully magnetic circuit breakers are important to users of circuit breaker equipment. To sum up: (1) They will save you engineering application time. (2) They allow great flexibility of placement. (3) They can be reset quickly.

We will be happy to send you more information on fully magnetic circuit breakers and a copy of the revised Federal Specification W-P-131a with Amendment-2. Write to:
Murray Manufacturing Corporation, 1250 Atlantic Ave., Brooklyn 16, N. Y.

FOUR BILLION DOLLARS . . .

. . . . will be spent for new plant in 1952 by all units of the electrical industry! That's the big fact in the figures Electrical World will publish on January 28 when the editors present to the industry their Annual Statistical Report.

For the first time all units of the industry—private electric light and power companies, municipal, state, and power district utilities—will be included in the statistics along with the Bureau of Reclamation, Corps of Engineers, TVA, and electric coops. Thus for the first time in 48 annual starts the editors offer their readers a truly All-Industry Report.

This year's data is based on returns from units of the industry representing 88.1% of the nation's generating capacity and more than 85% of the customers served. It is notable that the figures on activities of the nation's Rural Electric Cooperatives are based on coops serving 26.7% of the customers served by utilities of this type.

And now that we have carefully set down where the statistics come from and what they include, let's lift the curtain for a moment and look under it at some of the more outstanding facts of 1951:

Net Income of private utility dropped for the first time since 1942 due—you guessed it—to taxes.

Revenue, on the other hand, was up. We estimate that it reached $5,640 million by year's end.

Generating capacity installed on November 1 had reached a total of 74,678,000 kw.

Energy Production at year end it estimated at 370,536 million kwhr for the entire industry.

Manufacturing indexes were up sharply except for the one associated with electrical appliances. It went down!

So much for the preview. For more information on the dimensions of this industry's magnificent accomplishments last year we invite you to watch for the 48th

ANNUAL INDUSTRY REPORT NUMBER

January 28, 1952

Electrical World

Published for 77 years for those engaged in the business of generating, transmitting, distributing or applying electric power

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Joe Humenik began his career at Okonite in 1911. Today, his 40 years of skill are part of the vast know-how which goes into every cable. Here, he is applying a braided cover to a 60,000 volt shock-proof X-ray cable developed at Okonite.

• • •

Joe's son Ed, one of the many second generation employees at Okonite, joined the company in 1940, served 4 years in the Navy, now inspects and packages Okonite's famed Manson friction tape.

THAT ELUSIVE "Something"

Pride in a job well done is all too rare these days. Yet pride in workmanship puts something into a product that neither machine nor material can contribute.

That elusive "something" is an integral part of every Okonite cable. Added to Okonite's premium materials and advanced manufacturing techniques, it spreads the extra margin of quality that tips the balance between a cable that's superior and one that is merely good enough.

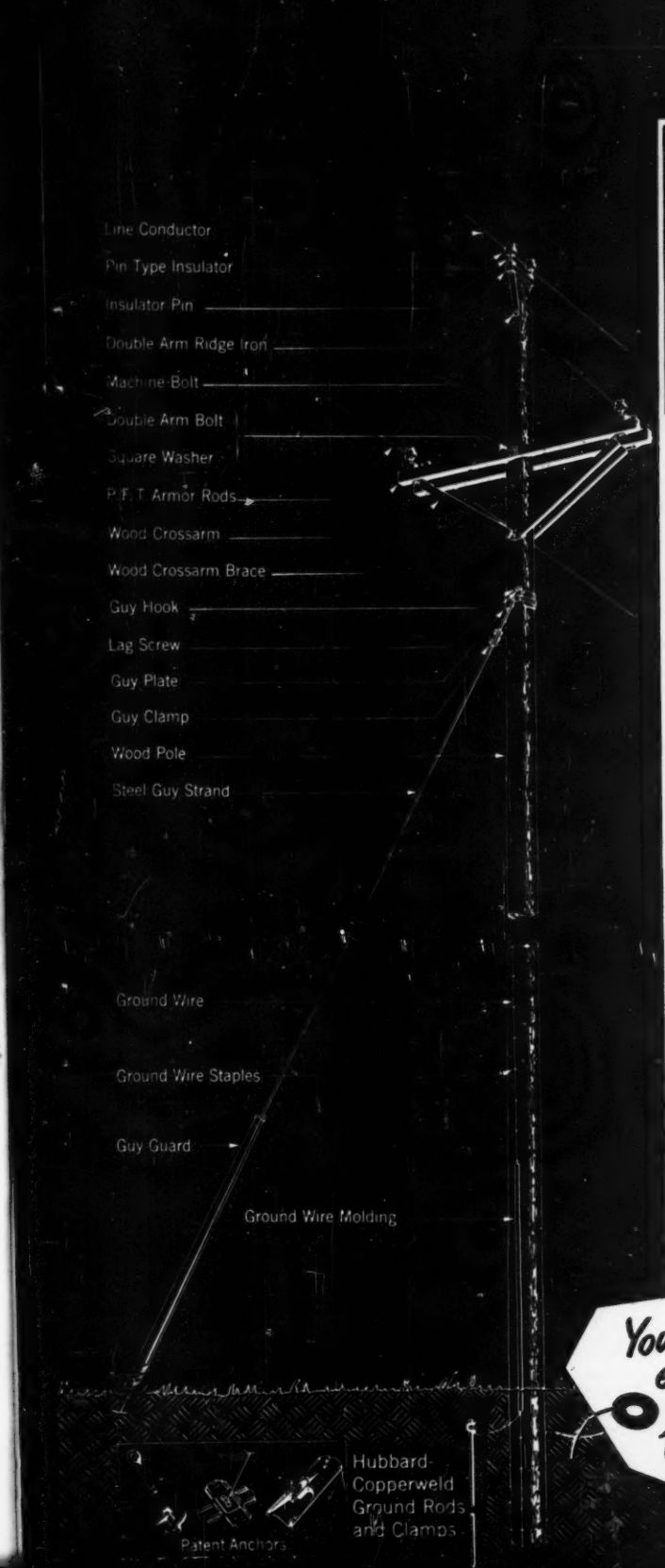
Meticulous care in the making of insulated cables contributes heavily to the performance of vital electrical circuits. It has helped to make Okonite cables the outstanding choice for reliability among leading utilities, railroads and heavy industries.

This craftsman's pride in his work is shared by countless Okonite employees. Better than one out of every six have worked here 20 years or more. Many are second, even third generation employees.

They're skilled workmen . . . proud of their jobs and proud of their company. The Okonite Company, Passaic, N. J.

THE BEST CABLE IS YOUR BEST POLICY

insulated wires and cables



From a single near-by source

everything from the bottom of the hole to the top of the pole

Why spend time shopping around for pole-line equipment and supplies? From near-by Graybar you can fill all your requirements with just one order—and be sure you're getting dependable items. By ordering all your pole-line needs from this single source, you save time and paper-work expense. You get the products of the leading manufacturers of poles, crossarms, insulators, hardware, strand, line trucks and tools.

As conditions permit, Graybar stocks many pole-line items in local warehouses in more than one hundred cities. By scheduling ahead with Graybar, you're sure of the best possible chance of having all your requirements filled and on the job site when needed.

When you call on Graybar, for supplies or for information, your needs are understood and accurately met. That's because Graybar has been familiar with pole-line requirements ever since the first lines went up. Experienced Graybar Outside Construction Specialists are on call to help you solve unusual problems in the planning of any pole-line or underground project. *Graybar Electric Company, Inc. Executive offices: Graybar Building, New York 17, N. Y.*

112-91

IN OVER 100 PRINCIPAL CITIES

You get the best of everything electrical

Via GraybaR

NOW... ANOTHER GREAT INSULATOR

PURIFIED

GREATER TOUGHNESS—GREATER DENSITY
GREATER MECHANICAL and ELECTRICAL UNIFORMITY

More than half a century of experience has gone into the creation of VICTOR PURIFIED PORCELAIN—the wet process porcelain of highest insulation values, unequalled density and rock-like strength and resistance to impact. Laboratory tests prove it to be the finest insulator porcelain ever made!

VICTOR PORCELAIN Is Truly PURIFIED

1. Only premium grades of flint, feldspar and clay are used.
2. Every shipment is stored in separate bins and tested for purity and uniformity before using.
3. All clay is de-aired to achieve porcelain of maximum density.

AND NOW... **all water used in processing is de-mineralized to remove the mineral salts which fuse during firing into microscopic, glass-like impurities!**

RESULTS: **Increased Impact Resistance... Greater Density... Greater Manufacturing Control... Greater Product Uniformity!**

DON'T SETTLE FOR ANYTHING LESS THAN VICTOR PURIFIED PORCELAIN
Get All the Facts from Your VICTOR Representative

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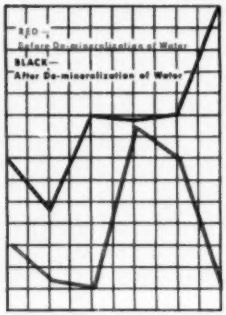
VICTOR PURIFIED PORCELAIN

Finest Insulator Porcelain Ever Made!

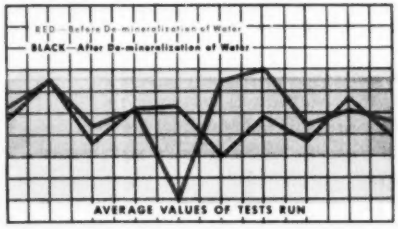
LABORATORY TESTS PROVE IT!



Results of Mechanical Impact Tests

MECHANICAL IMPACT TESTS*

Removal of mineral salts from the water used in processing VICTOR PURIFIED PORCELAIN results in an average of 18% higher mechanical impact values. The graph at the left shows actual values obtained from tests preceding and following installation of water de-mineralizing equipment.



Results of M & E Strength Tests Showing Range of Variation

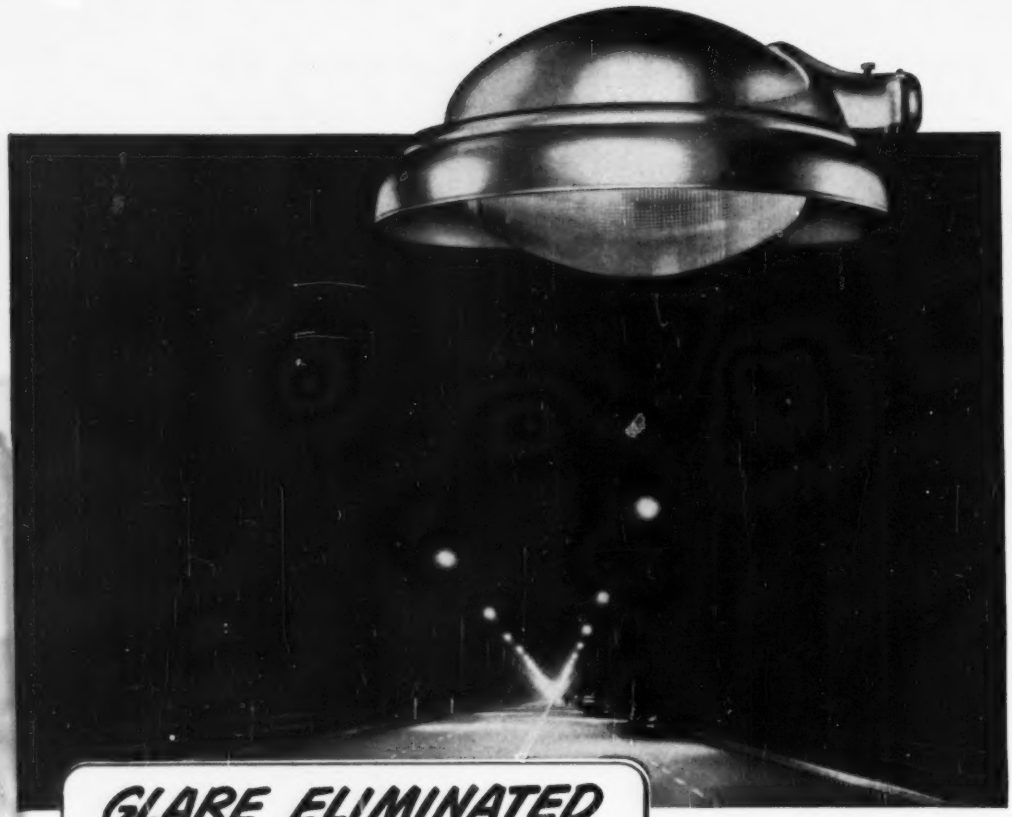
M&E STRENGTH TESTS*

Installation of water de-mineralizing equipment shows an improvement of 24% in the range of variation of M & E strength values over the range obtained before installation of this equipment. The graph above indicates the remarkable increase in uniformity of product.

*Tests made on VICTOR 10", 15,000 lb. suspension insulator.

VICTOR INSULATORS

VICTOR INSULATORS, INC. • VICTOR, NEW YORK



GLARE ELIMINATED

without sacrificing efficiency

California state highway specifications called for: *"high roadway brightness, with* additional shielding *to prevent distracting glare* . . . at a no more than 2% loss in lighting efficiency."

A special shield for the Westinghouse OV-20 mercury-vapor unit minimized glare and showed these results: *less than 2%* loss in efficiency.

With thousands now installed, they have discovered that this is also one of the easiest street lighting systems to maintain. Relamping is a one-hand operation, because of the hinged construction. Routine cleaning is speedy.

What's more, this unit provides lighting distribution patterns for both wide and narrow highways.

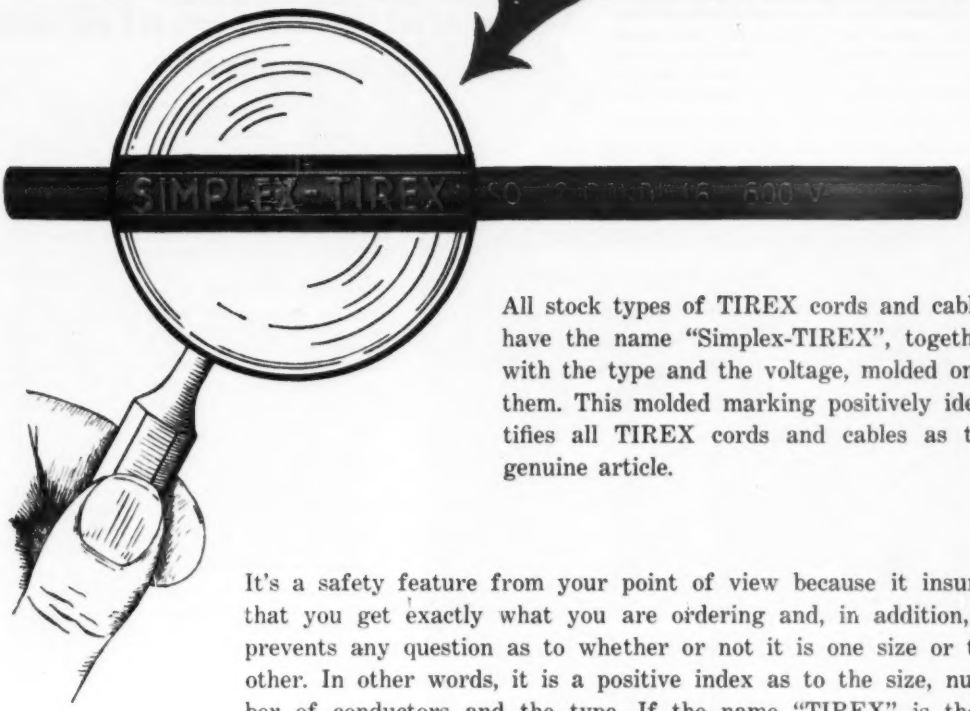
It will pay you to investigate the Westinghouse mercury-vapor street lighting systems. Send for B-3876-A, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-04300

YOU CAN BE SURE... IF IT'S

Westinghouse

PLANNED LIGHTING SYSTEMS

THIS IS THE MARK OF Quality



All stock types of TIREX cords and cables have the name "Simplex-TIREX", together with the type and the voltage, molded onto them. This molded marking positively identifies all TIREX cords and cables as the genuine article.

It's a safety feature from your point of view because it insures that you get exactly what you are ordering and, in addition, it prevents any question as to whether or not it is one size or the other. In other words, it is a positive index as to the size, number of conductors and the type. If the name "TIREX" is there it's your assurance that you are getting genuine Selenium Neoprene Armored TIREX.

The next time you need portable cords or cables be sure you specify TIREX and then be sure you get it by insisting that the cord or cable you get is marked "Simplex-TIREX".

TIREX SELENIUM

SIMPLEX-TIREX IS A PRODUCT OF SIMPLEX RESEARCH

SIMPLEX-TIREX

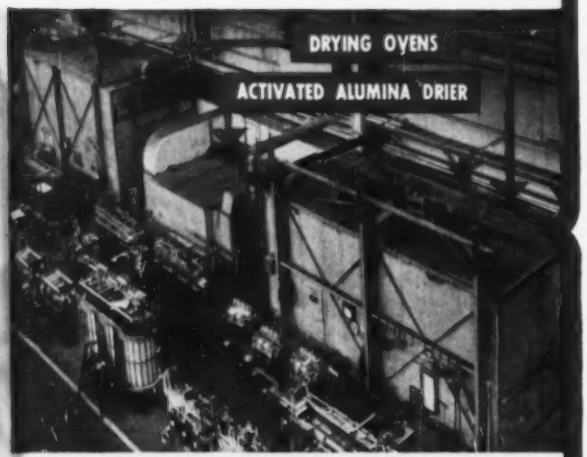
SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.

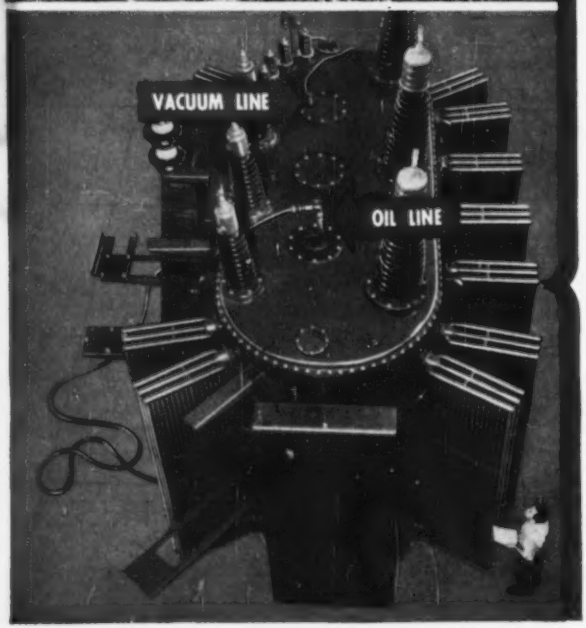
Pennsylvania Factory Procedures Put Lower Power Factors into Power Transformers

A recent check of approximately 300 Pennsylvania Power Transformers indicated that the power factor values for these transformers were under 2%, with many under 1%. This fine record is due in part to Pennsylvania's excellent procedures for:

- **Drying out transformer core and coil units**
- **Filling transformer with oil**

These factory procedures, maintained under careful control at all times, are part of Pennsylvania's over-all program to provide America's Utilities and Industrials with the best power transformers that can be made.





Drying of Transformers

Pennsylvania's low-temperature, low-humidity drying equipment consists of two specially designed ovens and an elaborate activated alumina air-drying system.

Integral parts of this equipment are: (1) an air recirculation system with a capacity of 12,000 cubic feet per minute, and (2) a pre-cooler that lowers the temperature of the air as it leaves the oven and removes the moisture from the air by condensation. Transformers can be dried in 24 to 48 hours at relatively low temperatures — approximately 75°C. This fast, low-temperature drying prevents deterioration of the insulation during the drying-out period, and thus greatly increases the useful life of the insulation. Proper dryness of the insulation is determined by taking power factor readings of the insulation during the actual dry-out process.

While they are still warm, transformers are removed from the ovens and placed directly into their respective cases. The core and coil units are not permitted to cool off and absorb moisture. By keeping the insulation dry, the low power factor values are maintained.

Oil Treatment of Completed Transformers

All power transformers are filled with de-aerated oil under vacuum in their own tanks.

Transformers designed for partial vacuum **are placed inside a large vacuum tank. By breaking up the oil into a fine spray as it enters the transformer tank, the air is readily removed by high vacuum.**

Transformers designed for full vacuum **are evacuated in their own tanks. Oil is brought into the transformer through spray nozzles while a high vacuum is maintained in the tank.**

Transformer being filled with oil while under vacuum.
30,000 Kva, 3 Phase, 60 Cycles, 154,000 Grd Y-115,000 Grd Y-12470Δ volts; Inert gas-oil seal system of oil preservation; tank braced for full vacuum.

Pennsylvania
TRANSFORMER COMPANY
Canonsburg, Pa. • Greater Pittsburgh District

Fewer equipment failures—less "down-time" through SCHEDULED PREVENTIVE MAINTENANCE

If you'd like to read a case history that shows how "the other fellow" in the utility business is making big savings in caring for his expensive equipment – send today for free folder KD656.

Just off the press, this informative folder tells in detail the 20 years' experience of The Kansas Gas and Electric Co. with the Kardex preventive maintenance system designed for their Generating Department. They avoid expensive repairs with a simple system which flashes notice when inspections are needed in ample time for effective, economical action. Kardex is not only the simplest means of achieving this result, but the most unfailing. You *can't miss* the warning Kardex signals.

Don't take our word for it. Read the facts and judge for yourself what such a system could do for *your* equipment, *your* operating costs. Mail the coupon today – while it's on your mind.

Send for this FREE booklet today

Remington Rand INC.

Management Controls Library, Room 1608
315 Fourth Ave., New York 10, N. Y.

Yes, I would like your booklet KD656.

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GOULD

Plus-Performance Plan

. . . HELPS EXTEND YOUR BATTERY POWER BY HELPING YOU TO

KNOW THE CONDITION OF YOUR BATTERIES!

Knowledge of the condition of your batteries is important because: (1) you know when batteries should be replaced to assure you of uninterrupted power and (2) you can be sure of correct charging and systematic maintenance. For these reasons, the GOULD PLUS-PERFORMANCE PLAN emphasizes the various ways to determine battery condition.

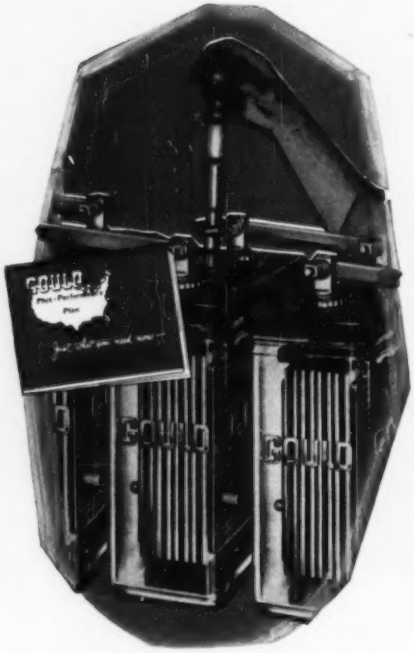
The GOULD PLUS-PERFORMANCE PLAN is a complete library of technical information consisting of manuals, articles, specifications, bulletins, record cards, charts and graphs covering every phase of battery care. It gives you information on how to select, charge, handle, maintain, inspect and test that can improve your battery performance as much as 50%! It's FREE. Write for booklet describing the plan.

DETERMINING STATIONARY BATTERY CONDITION

VISUAL INSPECTION can tell you the electrolyte level, amount of sediment and the physical condition of the plates. If the sediment space is filled or portions of plates have fallen into this space, battery should be replaced.

RECORD pilot cell gravity and voltage readings daily. Periodically record all cell voltage and gravity readings following equalizing charge. Compare with previous readings to determine whether cells are uniform and in good condition.

TEST DISCHARGE, to determine the condition of the battery, is done by discharging a fully charged battery at a constant rate until the battery is not more than 80% discharged. Comparison of cell voltages with manufacturers' curves shows whether battery is delivering rated capacity.



Temperature and specific gravity readings give an indication of battery condition.

GOULD **STORAGE BATTERIES**

GOULD-NATIONAL BATTERIES, INC., TRENTON 7, NEW JERSEY

Always Use Gould-National Automobile and Truck Batteries

You can profit

from Manchester's Experience

Quick, Easy Expansion with Westinghouse Network Transformers

Public Service Company of New Hampshire envisioned Manchester as a city sure to grow . . . power requirements certain to increase. That's why an underground secondary network system was installed . . . to give the flexibility needed to accommodate extensions, load shifts and future growth *economically.*

Already these predictions have come true. But the network system offered a simple solution. A number of new 500-kva Westinghouse Network Transformers were quickly and easily installed throughout the city.

Here's the transformer that offers greater savings in initial cost . . . and these *plus* features:

STANDARDIZED electrically and mechanically to meet industry requirements . . . to improve delivery and reduce costs.

CONTINUOUS WINDINGS with sliverless copper.

HIGH AND LOW-VOLTAGE COILS accurately centered to minimize short-circuit stresses.

SINGLE RESPONSIBILITY—transformer, network protector, rotary switch all supplied by one manufacturer.

Westinghouse helped develop the network system over 29 years ago and has continuously pioneered new developments. Complete facilities including board analysis and competent engineers can help with your system planning. Call your nearest Westinghouse representative or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-70614

YOU CAN BE SURE . . . IF IT'S

Westinghouse

NETWORK TRANSFORMERS

Choose from 78 Trucks and

You are invited to request the FWD "CODE BOOK" which makes it easy for you to select the motorized unit best suited to your work.

Also, upon request, you will be shown a 20-minute movie, demonstrating FWD performance in utility line construction and maintenance. Ask FWD or your nearby FWD distributor.

THE FOUR WHEEL DRIVE AUTO CO.
Clintonville, Wis. • *Canadian Factory:* Kitchener, Ont.
World Wide Sales and Service

You buy more than a truck when you buy an FWD

Extra traction and proper distribution of weight and power give you all this:

- Ability to *follow the job* safely, on or off the highway.
- Ability to restore service faster — meet construction schedules — regardless of weather.
- Lower maintenance cost.
- Up to twice the truck life.

Combinations of Equipment . . .

FWD is the CENTRAL SOURCE for complete mobile workshops . . . including cabs, winches, derricks, boring machines, platform and line bodies

FOR LINE MAINTENANCE

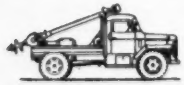
. . . FWD gives you the extra ability to *restore service faster!* Bad weather doesn't slow up FWDs. They *safely* carry men and equipment right to the trouble spot! They are the *economical* answer in all types of *routine* and *emergency* services.

FOR LINE CONSTRUCTION

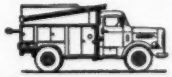
. . . with FWDs you're able to stick to your schedule and meet deadlines. FWDs travel *where* and *when* other trucks can't operate! You can do more work per day — and at lower cost — because FWDS conserve valuable manpower!

WHAT ARE YOUR TRUCK PROBLEMS?

FWD matched combinations answer needs such as these:



FOR CONSTRUCTION — Consists of earth boring machine with integral derrick, winch and platform body . . . on light duty, medium duty or heavy duty FWDs.

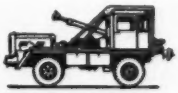


FOR MAINTENANCE — Conventional 3 man cab with line maintenance body, winch, derrick. Combines with light duty, medium duty or heavy duty FWDs.

FOR MAINTENANCE—2 man cab over engine style with crew compartment in maintenance body. Winch and derrick. Matched with medium duty FWD chassis.

FOR MAINTENANCE — Conventional 3 man cab with crew compartment in maintenance body. Winch and derrick. For light duty, medium and heavy duty FWDs.

GENERAL PURPOSE TRANSPORT — H 6 x 6 with 5th wheel for use with lo-boy, semi-trailer, full 4 wheel or pole trailer. Winch mounts behind 3 man cab. Tool compartment under platform.



FOR CONSTRUCTION (and maintenance of energized lines) — For one-man operation. Patented. Front mounted earth boring machine with integral telescopic derrick — rear mounted engine — winch. For heavy duty FWD.

ALL PURPOSE LINE MAINTENANCE AND CONSTRUCTION—2 man cab-over-engine. Crew compartment in combination platform and line body. Includes earth boring machine, derrick, winch. For medium duty FWD.

FOR MAINTENANCE — Heavy Duty 6 x 6 has conventional 3 man cab. Crew compartment built into maintenance body. Matched combination includes winch and derrick.

We Gain TWO WAYS

with Westinghouse Induction Regulators

Westinghouse Induction Regulators installed at urban substations give double duty. They're dollar *makers* and dollar *savers*. They assure maximum revenue by faithfully delivering adequate and sustained voltage. They cut regulating costs because Westinghouse design provides sure operation with minimum maintenance.

New electrical controls simplify adjustments over the complete range of balance voltages and band widths. Dependable settings are simply a matter of turning dials . . . as easy as tuning in a radio. The voltage level setting is accurately calibrated, permitting adjustment without disturbing the line-drop compensator. Either may be adjusted without interrupting the operation of the regulator.

Sturdy regulator construction assures long, trouble-free life. All relay moving elements are mounted on stainless steel spring hinges. Thus, maintenance inherent with bearings is eliminated. Metallic contact of the pole faces on the motor-operating relay has been entirely eliminated by use of the spring-supported, snap-action element, making it impossible for the relay to stick because of residual magnetism.

Westinghouse Induction Regulators are available in three types, to meet all urban station requirements . . . your choice of oil-cooled, air-cooled or inerteen-cooled construction. Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-10371

YOU CAN BE SURE... IF IT'S

Westinghouse

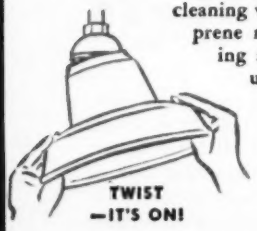
VOLTAGE REGULATORS

NEW APPLETON V-51 SERIES

CONVERTIBLE VAPORTIGHT LIGHTING FIXTURES

WITH MALLEABLE IRON BODIES
100 WATT OR 150-200 WATT

EXCLUSIVE UNIT ASSEMBLY!



TWIST —IT'S ON!

Never before a vaportight lighting fixture so safe, so efficient, so easy to install . . . so economically serviced and maintained!

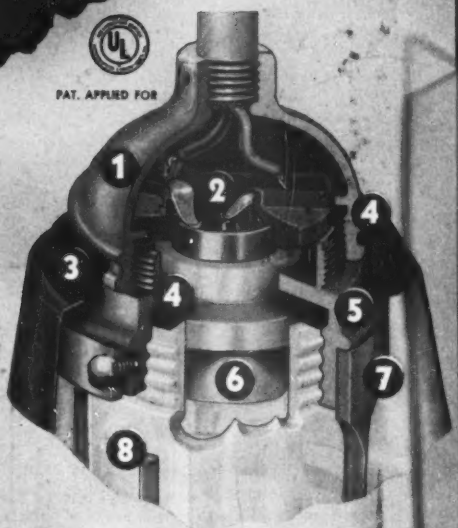
Combined in an exclusive "Unit Assembly," receptacle, globe and guard are detachable as a *single unit* instantly, without tools! Re-lamping or cleaning becomes safe, swift and simple. One trip up the ladder to exchange assemblies, and the job's done!

This outstanding new V-51 line includes 18 different types of rugged malleable iron bodies for pendant, ceiling or bracket mounting. Each body takes both 100 Watt or 150-200 Watt "Unit Assemblies." Each body, except bracket types, is grooved to mount four reflector styles in three different sizes. This *complete interchangeability of parts* permits the assembling of 256 complete fixtures, using only 32 basic components.

Reflector is quickly attached or removed for cleaning without tools—thanks to exclusive neoprene rubber ring attachment. Shock-absorbing socket in "Unit Assembly" permits the use of standard lamps where costlier mill-type lamps were formerly used.

For full details on this great new fixture, write for Bulletin 5-A.

PAT. APPLIED FOR



NEW—INSIDE AND OUT

Sectional View Shows Outstanding New Design and Operating Principles.

1. Malleable iron fixture body.
2. Connecting block with spring leaf contacts.
3. Neoprene rubber ring holds reflector.
4. Vaportight gaskets.
5. Globe and guard adapter body.
6. Shock-absorbing socket.
7. Snap-on type guard.
8. Vaportight globe.

Sold Through Electrical Wholesalers

APPLETON ELECTRIC COMPANY

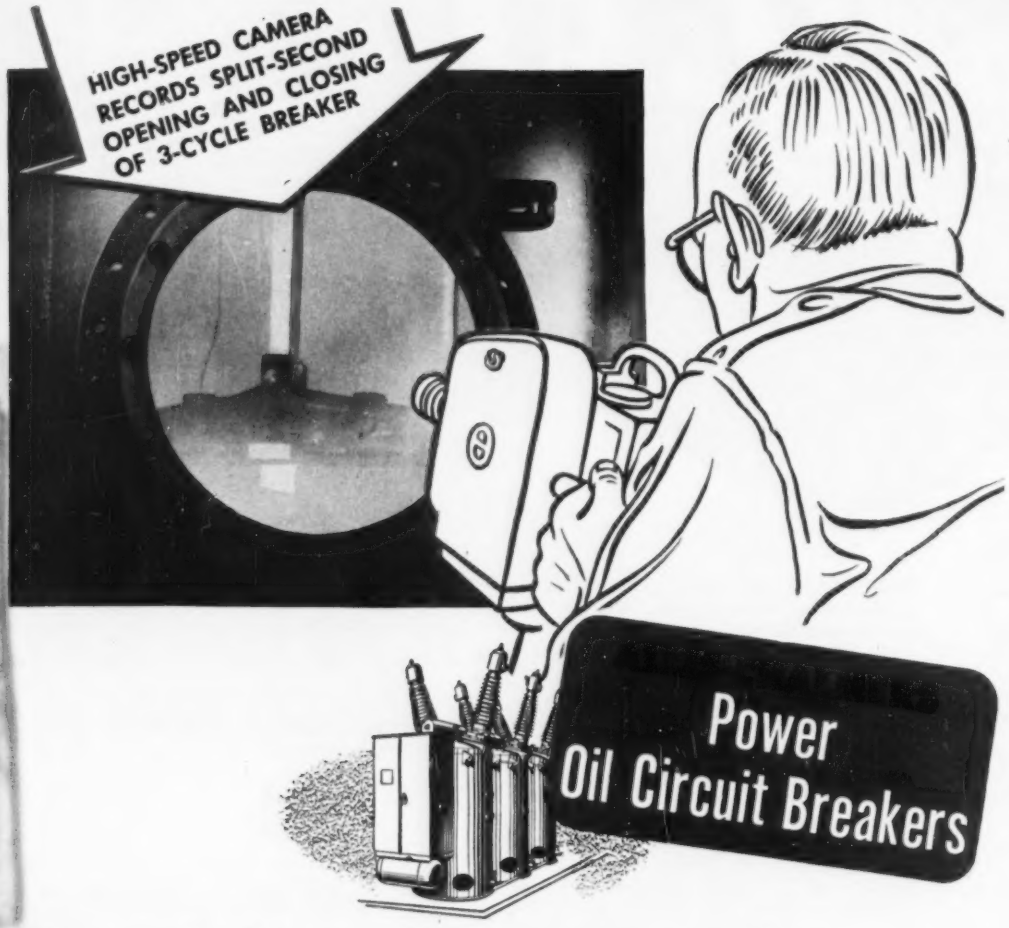
1705 Wellington Avenue • Chicago 13, Illinois

Branch Offices: NEW YORK, 50 Church St. • DETROIT, 3049 E. Grand Blvd. • CLEVELAND, 1836 Euclid Avenue • SAN FRANCISCO, 655 Mission St. • ST. LOUIS, 227 Frisco Bldg. • LOS ANGELES, 300 N. Santa Fe Ave. • ATLANTA, 724 Boulevard, N. E. • BIRMINGHAM, 429 Brown-Marx Bldg. MINNEAPOLIS, 305 Fifth St., S. • PITTSBURGH, 414 Bessemer Bldg. • BALTIMORE, 100 E. Pleasant St. BOSTON, 10 High Street • DENVER, 1921 Blake Street • PHILADELPHIA, 1017 Cherry Street CINCINNATI, 626 Broadway • HOUSTON, 709 M. & M. Bldg. • HAVANA, Cuba, Malecon No. 9.

Resident Representatives: Binghamton, Dallas, Indianapolis, Kansas City, Orlando, Milwaukee, New Orleans, Seattle, Portland, Ore.

Export Representatives: International Standard Electric Corp., 67 Broad St., New York 4, N. Y.

APPLETON ELECTRIC PRODUCTS



Positive Protection...

TODAY'S heavily loaded, complex transmission systems require dependable high-speed electrical protection. And Allis-Chalmers circuit breaker engineers are continually developing and testing new designs to provide faster performance and higher interrupting capacities.

Special test equipment permits detailed study of mechanisms in motion, including even the fastest operating parts. High-speed photography, for example, permits contact travel in oil to be recorded through a transparent manhole cover.

Extensive tests are made on each new design — first on separate components, then on the complete circuit breaker. Customer surveys confirm the importance of our emphasis on sound mechanical design and thorough testing.

Get the complete story on Allis-Chalmers circuit breakers from your nearby A-C district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-3581

ALLIS-CHALMERS

Now—All Your Utility Ledger Posting on One Machine!

The Sensational New Burroughs Sensimatic accounting machine

Yes, it is truly amazing the way the completely new Burroughs Sensimatic handles utility accounting jobs. And there's a good reason—for the Sensimatic was designed with the needs of utility companies in mind.

It's completely new from the ground up—built around a brand new principle, the control panel, or "mechanical brain," that directs the machine automatically through any four accounting applications, in any combination. Control panels are interchangeable instantly and there is no limit to the number that can be used—no limit to the number of accounting jobs a single machine can do!

The Sensimatic makes possible a great improvement in accounting speed, flexibility, and ease of operation. This means faster billing and posting, working-hours saved, increased output and, best of all, reduced accounting expenses. The Sensimatic is moderately priced, too.

Get the complete story of this sensational new Sensimatic today. Call your local Burroughs office or write Burroughs Adding Machine Company, Detroit 32, Mich.

HANDLES ALL THESE JOBS—*and more*

Operating Ledgers • Work Order Ledgers • General Ledger • Material and Supplies Ledger • Bank Ledger • Revenue Ledgers • Accounts Receivable Control Ledgers • Stockholders Ledger • Operating Statements

WHEREVER THERE'S BUSINESS THERE'S **Burroughs**

SPIRAKORE TRANSFORMERS

GIVE EXTRA YEARS OF SERVICE

Soaked in the flood...

"We cleaned and tested the first few of the newer transformers," said city engineer, Harvey Earp, "and found that no water had gotten in, . . .

"so we just hosed down the remaining Nitrile-sealed transformers, gave them a routine check, and put them back on the lines."

G-E Spirakore* Transformers stay moisture proof!

When the flood hit the city of Osawatomie, Kansas, it completely submerged a number of distribution transformers. Yet service was restored in most areas only a few hours after the water receded.

This speed was possible because of the fine work done by the repair crews . . . *and the water-tight seal on G-E Spirakore transformers.* Although water did leak into some transformers of older design, every one of the Nitrile-sealed Spirakore transformers came through unharmed. The first Nitrile-sealed transformers recovered were cleaned and found undamaged—so the rest were merely washed with a hose, given a routine inspection, and put back in service without an inside tank check. And they are still on the job!

Nitrile Gaskets Used in Every Opening! Not even flood waters could get into Spirakore transformers because every opening—for cover, hand-hole and bushings—gets sealed with a Nitrile gasket. Completely air-tight, water-tight, this sealing eliminates transformer breathing—prolongs the life of both oil and insulation. Because no cement or sticker is used, gaskets can be removed easily—are reusable.

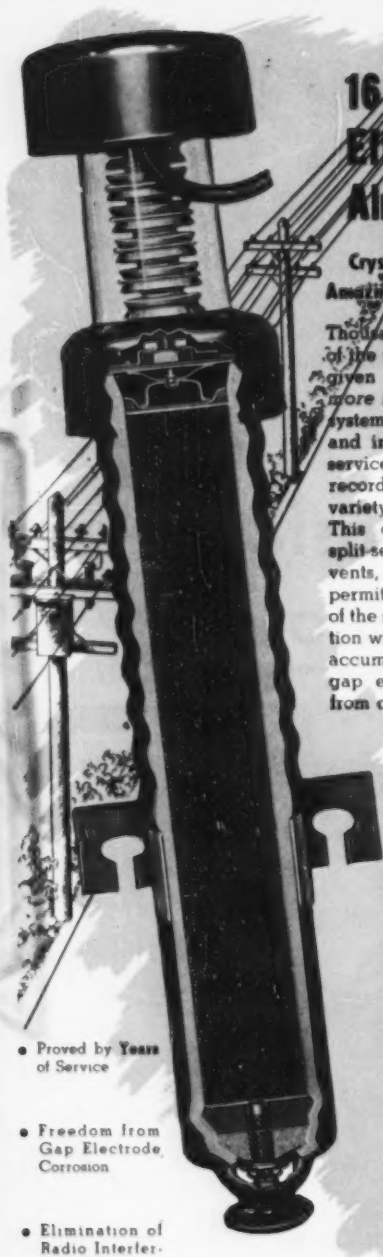
Better sealing is just one of the design features that make Spirakore the finest transformer obtainable. Bulletin GEA-5400 describes many more. If you haven't a copy, write for one today. Address *General Electric Co., Schenectady 5, N.Y.*

*Reg. Trade-mark of General Electric Co.

"The Nitrile seal," continued the city engineer, "kept our Spirakore transformers air-tight and helped us get our system back in service just a few hours later."

402-117

GENERAL ELECTRIC



16 Years Operating Efficiency... Almost 100%!

Crystal Valve Arresters Establish Amazing Record of Efficient Protection

Thousands of Crystal Valve Arresters of the ventilated spark gap type have given unsurpassed performance *for more than 16 years* on distribution systems both here in the United States, and in foreign installations. Careful service checks indicate a performance record of almost 100% under a wide variety of service conditions.

This outstanding arrester provides split-second protection. The spark gap vents, an important design feature, permit movement of the air in and out of the spark gap housing, and circulation within the housing. This prevents accumulation of moisture, protects gap elements and housing interior from corrosion.

Other features include: glass housing for the gap structure on arresters that operate at the higher voltage ratings—inspection made easy, multiple arcing unit with smooth discharge surfaces, high speed operation. Oxidized silicon carbide valve element assures low IR voltage drop, high surge discharge capacity. Available in five voltage ratings.

Crystal Valve Lightning Arresters offer complete protection and service that lasts.

- Proved by Years of Service
- Freedom from Gap Electrode Corrosion
- Elimination of Radio Interference

Write Dept. 1709 today for new folder describing in detail Crystal Valve Ventilated Spark Gap Arresters. Ask for No 433.

ELECTRIC SERVICE MANUFACTURING CO., PHILA. 32, PA.

CRYSTAL VALVE

LIGHTNING ARRESTERS

What Makes A Good Spark Gap Assembly?

by

J. R. McFarlin, Vice President

ELECTRIC SERVICE MANUFACTURING CO.

Spark gap assemblies of valve type lightning arresters are vitally important elements of the arrester; they ordinarily consist of a series of individual gaps formed from electrodes separated by insulating spacers, and properly assembled on an insulated support; the number of individual gaps and their sparkover value is dependent on the voltage rating of the arrester; such assemblies may appear to one to be simple and ordinary structures but have you ever given thought to some of their technical aspects?

For instance, do you know why brass is ordinarily used for spark gap electrode? The reason dates back to 1892 when Alexander Wurts published results of his classic experiments on non-arcing metals for spark gap electrodes; Wurts found that the best non-arcing properties were found to exist in the metals covered by Group 2 of Mendeleff's "Periodic Arrangement of the Elements"—beryllium, magnesium, calcium, zinc, strontium cadmium, barium, mercury, radium; obviously zinc was the most practical. Zinc itself has too low a fusing point to be satisfactory as a gap element, so it was alloyed with copper, the alloy was found to be highly satisfactory and as a result, from about 1892 to the present day, practically all valve type arresters have had spark gap electrodes made of brass.

Many other factors enter into the design of efficient spark gap assemblies—zinc content of brass used, its hardness, shape of electrodes and discharge surfaces, accuracy of electrodes and spacers, inter-electrode capacitance, grading, sparkover characteristics—all of which are important in this element of the arrester.

Why do Crystal Valve lightning arresters use the particular gap assemblies they do? Back in 1916 this Company designed a spark gap unit, many millions of which have been used in various types of arresters since that time. The electrodes were circular in shape and made of brass; the arcing surfaces were somewhat flattened and smooth; they were used as single gaps and in multi-gap assemblies; in 1916 electrode spacers and supports were made of molded plastic—since 1926 they have been made of steatite; in 1916 and to date manufacturing tolerances on all parts have been held to exceptionally close limits.

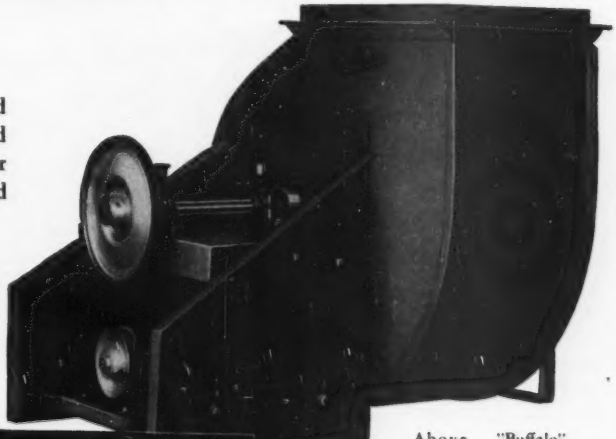
Since their development in 1916 considerable research has been done in attempts to improve the excellent characteristics of these electrodes and assemblies. Result? The spark gap structures used in Crystal Valve arresters of today are fundamentally the same as were used in arresters of our manufacture some 35 years ago and are one of the components responsible for the oustanding performance of these arresters over a period of some 26 years.

(Advertisement)

Customers appreciate the way "Buffalo" FANS perform on the job!

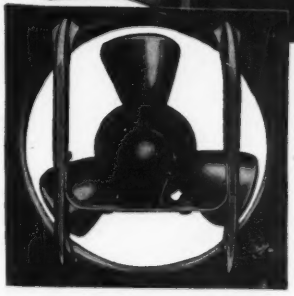
EASY TO SELL AND INSTALL -- REPEAT BUSINESS BUILDERS, TOO!

So many contractors have discovered it—you install one "Buffalo" Fan, and it's so satisfactory that the customer comes to you for his next fan job, and sends customers to you. "Buffalo" Fans have been pleasing particular industrial customers for 74 years now. And best of all, "Buffalo" Fans are made from the point of view of the man who installs them—they're not fancy, they're not cheapened in the manufacturing process. They're well-engineered in every part—built to move maximum air on minimum power, to do it quietly and to last a lifetime. So for best all-around results on your next fan installation, make it "Buffalo"!



Above, "Buffalo" Belted Vent Set, one of our most popular light-duty fans for centralized ventilation. Complete unit, ready to install.

WRITE FOR BULLETIN 3720



Left, the panel wall fan they all want, because it's low in first costs, simple to install, costs little to run —the BREEZO Fan!

WRITE FOR BULLETIN 3222-F.

"Buffalo" FIRST FOR FANS

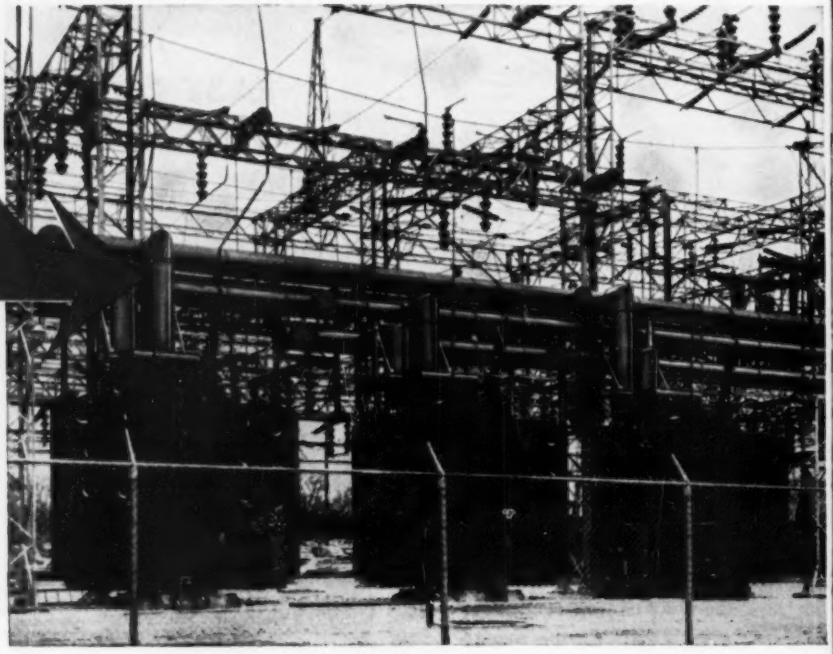
BUFFALO FORGE COMPANY

212 MORTIMER ST. BUFFALO, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont. Branch offices in all Principal Cities

VENTILATING FORCED DRAFT | AIR WASHING COOLING | AIR TEMPERING HEATING | INDUCED DRAFT EXHAUSTING PRESSURE BLOWING

FIRST STEP
TOWARD SERVICE CONTINUITY...

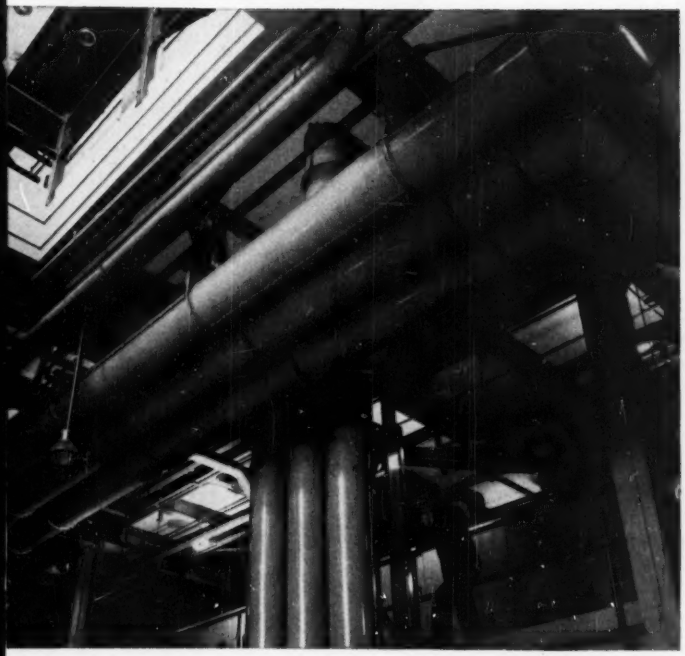


Generator leads—

that satisfy your requirements

These key links in power generation and distribution systems must have high dielectric and mechanical strength. I-T-E Isolated Phase Bus is designed and built to meet all the electrical and mechanical essentials.

I-T-E Isolated Phase Bus can be used indoors or outdoors—on long runs or short runs. It can be threaded through complicated mazes of piping and conduit. Connections to transformers and other auxiliary equipment are neat and easy.



easy-to-order

Working from a simple, single line diagram of your circuit and building, I-T-E supplies finished drawings and a quotation for a complete bus.

And the bus production capacity of I-T-E and its R&IE Equipment Division is sufficient to satisfy the requirements of all the generators now being produced in the United States.

easy-to-install

Readily adaptable to any building contour, I-T-E Isolated Phase Bus may be furnished in sections of three phase units, when required. It may also be delivered as packaged parts—to meet particular installation problems.

proved in service

I-T-E Isolated Phase Bus has been transmitting the power from the largest generators since 1936. Over 24 conductor-miles in 213 installations are in service today.

For further information, write for Catalog Section 10004. I-T-E Circuit Breaker Company, 19th and Hamilton Streets, Philadelphia 30, Pennsylvania.

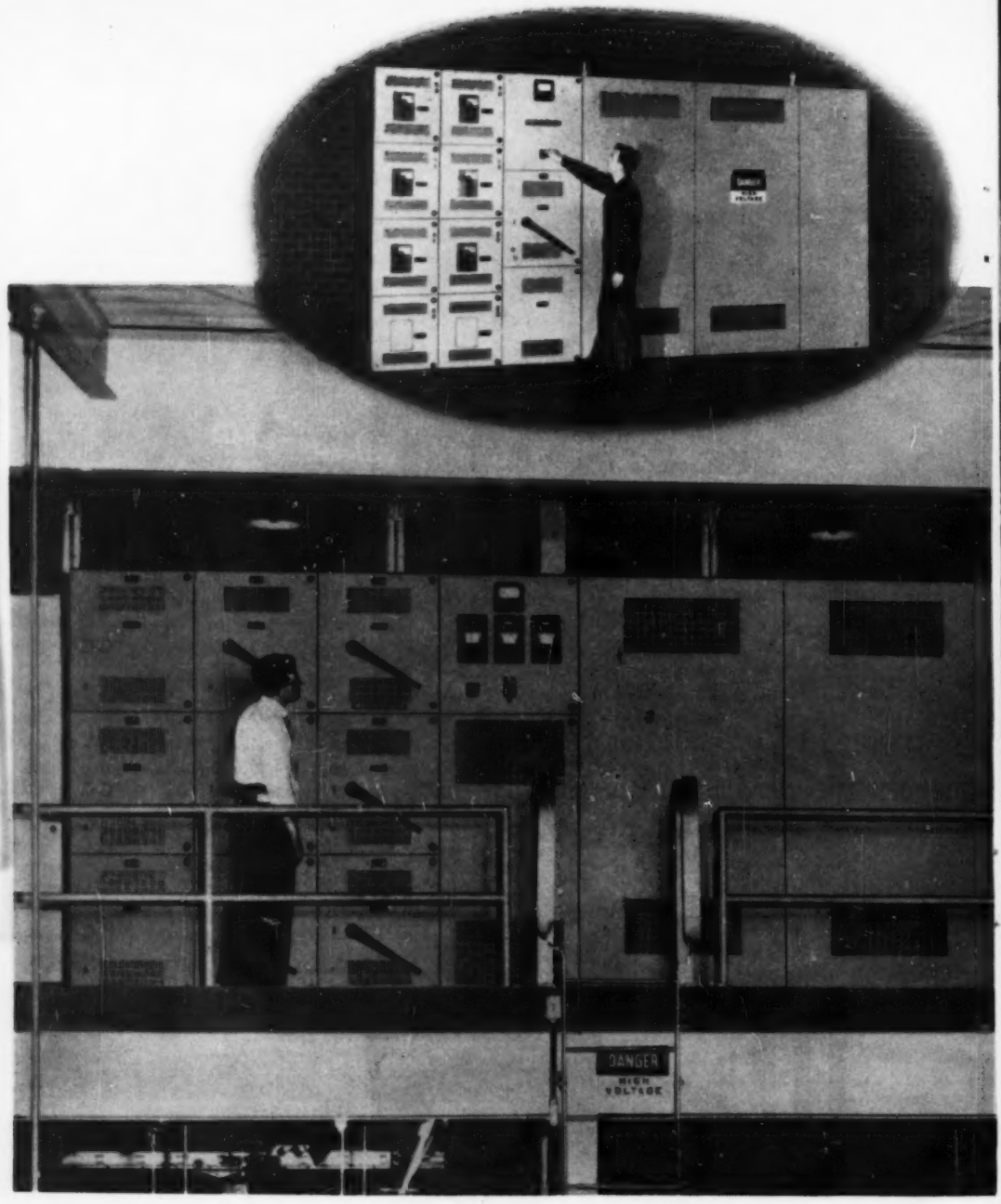
I-T-E

ISOLATED PHASE BUS

Power Switching Equipment:
R&IE Equipment Division, Greensburg, Pa.

Canadian Mfg. and Sales:
Eastern Power Devices, Ltd., Toronto

Export Sales:
Philips Export Corp., N. Y., N. Y.


DANGER
HIGH
VOLTAGE

Westinghouse Power Centers

Trim Power Control Costs

for Chicago Pneumatic Tool Company

Six Westinghouse Power Centers, consisting of dry-type transformers and switchgear, are serving operations in Chicago Pneumatic Tool Company's new plant at Utica, N. Y. And their favorable effect on power control costs—summed up in the following statement—suggests a savings opportunity for you.

"By bringing high voltage to the power centers, heavy copper from the main substation was avoided . . . voltage regulation and voltage drops were well within acceptable limits. Compact design enabled us to place some of the units on a small mezzanine to provide more space for production on the main floor.

"Since all units are duplicates, we enjoy maximum interchangeability and a resultant savings in spare parts. For future convenience and economy, spare feeder compartments are equipped to take additional breakers as the load increases."

Dry-type power centers will enable this user to realize even further savings. The elimination of vaults, oil conditioning and testing, promises a saving in routine maintenance. Freedom from fire hazard warrants lower insurance rates. Maintenance of a good voltage condition assures more efficient performance of manufacturing equipment.

GET THE COMPLETE STORY

Westinghouse Power Centers are the key to efficient power distribution. They offer better service continuity, greater flexibility, better regulation . . . all the things that contribute to power control economy. Most important, they provide the simplest, lowest-cost means of attaining the power system that best meets your operating requirements.

Booklet B-4162 covers Westinghouse Power Centers in detail. Booklet B-4045 discusses various types of plant distribution systems wherein power centers offer maximum advantage. For your copies, contact your Westinghouse representative or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60763

YOU CAN BE SURE . . . IF IT'S

Westinghouse

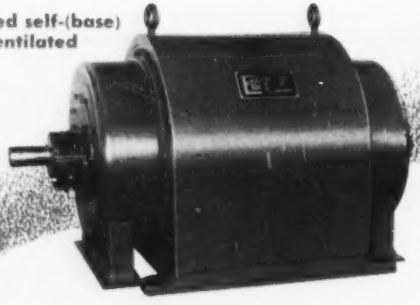
POWER CENTERS

How ELLIOTT fabri-steel fits the motor to

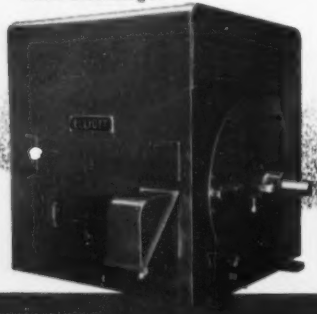
■ One of the many advantages of Elliott Fabri-Steel motors is the comparative ease with which motor enclosures can be devised, actually tailor-made to meet practically any reasonable operating condition. This unique adaptability is illustrated on these pages. It is applicable to all Elliott "Fabri-Steel" motors. Full information and data on request.

Modified frame
for top discharge

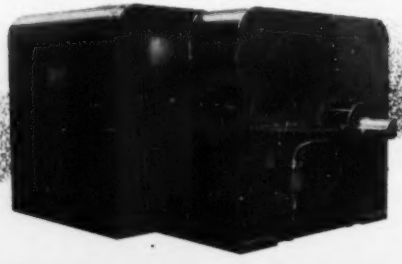
Enclosed self-(base)
ventilated



Totally-enclosed, fan-cooled
with top-mounted air-to-air
heat exchanger



Totally-enclosed, water-cooled with side-
mounted air-to-water heat exchanger



Elliott Company builds
a complete line of motors from 1 hp up

ELLIOTT

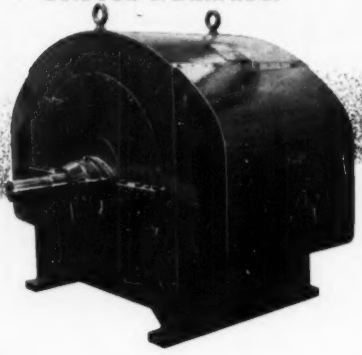
Dept. EW • RIDGWAY DIVISION

construction the need!

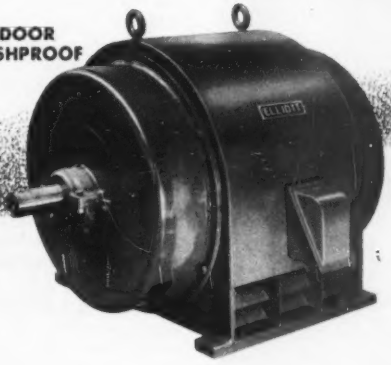
For instance, consider a standard, dripproof, squirrel-cage induction motor . . .

Without change in electrical design, this motor can be provided with enclosures ideally designed to meet the widest variety of special conditions, as shown in the following illustrations . . .

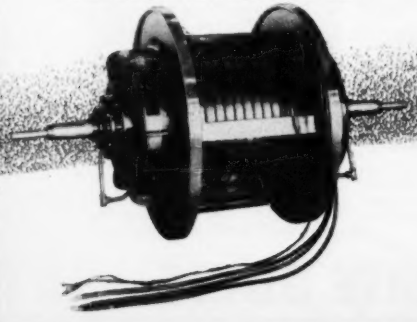
OUTDOOR SPLASHPROOF



INDOOR SPLASHPROOF



Round frame for mounting inside a duct system with a F. D. fan drive on both tapered shaft extensions



Modified to a vertical outdoor splashproof design

Elliott FABRI-STEEL MOTORS AND GENERATORS

L-817

Company

• SIDNEY, PA.

Easy to install...

That's why TRANSITE DUCTS save time, labor and money

THESE "ON THE JOB" photographs show why savings begin right at the start of the installation when you use Transite* Ducts.

The light weight of Transite Conduit and Korduct permits hauling a substantial footage of duct per truck. Handling is fast, too, because the asbestos-cement composition of Transite Ducts makes them strong and tough. The longer length of each duct . . . 10 feet . . . reduces the number of joints in the completed line. And joints are quickly made with the Transite Tapered Coupling that is engineered to stay tight in service.

For the full story of how Transite Ducts can reduce your cableway costs, write Johns-Manville, Box 290, New York 16, New York.

4 OTHER REASONS WHY TRANSITE DUCTS DO A BETTER JOB AT LESS COST:

1. Corrosion-Resistant. Transite, being made of inorganic asbestos and cement, resists corrosion and is immune to electrolysis.

2. Permanently Smooth Bore. Transite makes long cable pulls easy. Danger of damage to cables is also minimized.

3. Incombustible. Transite will not burn nor contribute to formation of smoke, gases, or fumes . . . confines burn-outs and protects adjacent cables permanently.

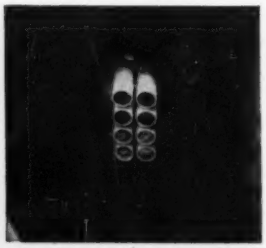
4. Higher Thermal Conductivity. Cables run cooler in Transite, reducing I^2R losses, increasing current capacity and prolonging insulation life.

Easy to Handle: Working in a deep trench, this man finds that the light weight of Transite Ducts helps him work without undue strain.

*Reg. U. S. Pat. Off.

Speeds Installation: Transite Ducts are joined so rapidly that the assembly man can often follow right behind the trencher . . . as shown in this installation.

Speeds Distribution: The light weight of Transite Conduit enables the contractor to haul a large number of ducts per truck and speed distribution on job site.



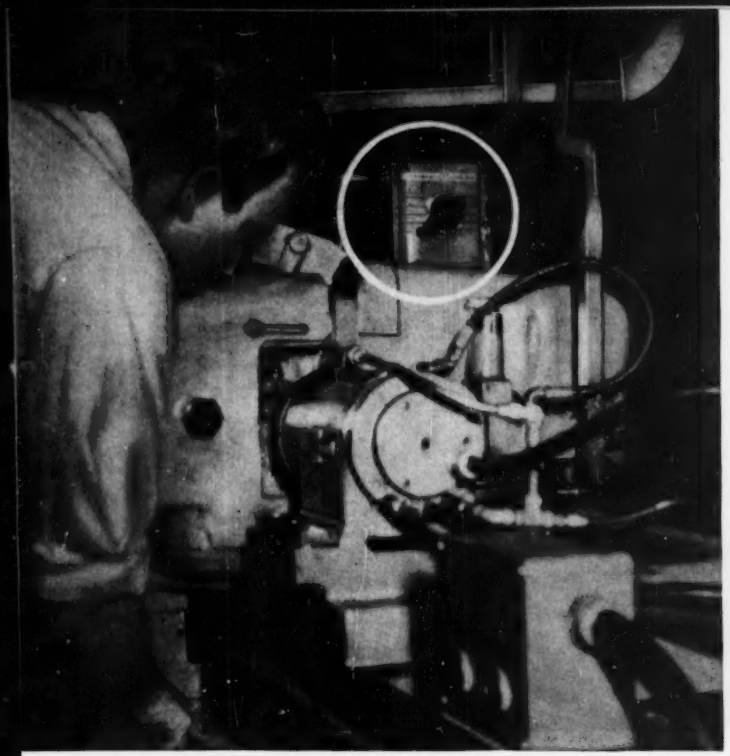
Cuts Manhole Costs: Concrete will be poured directly around these Transite Ducts to form the manhole wall, a time and material saving made possible by Transite's strength.

Johns-Manville TRANSITE DUCTS

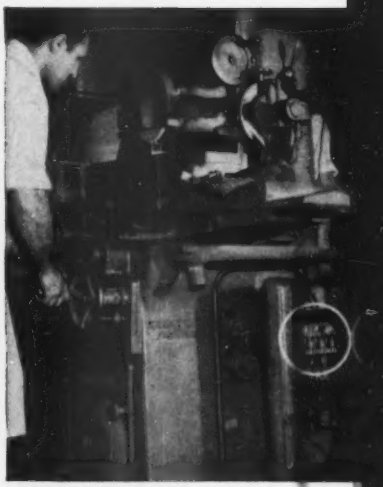
JM PRODUCTS

TRANSITE KORDUCT—For installation in concrete

TRANSITE CONDUIT—for exposed work and installation underground without a concrete encasement



IN SAFETY SWITCHES—Marlin-Rockwell Corporation's ball bearing factories use 30 ampere HCI switches as disconnects for high frequency motors used to power internal grinders. HCI interior is removable for easy wiring and inspection. No exposed live parts when switch is OFF and door open. Underwriters' Laboratories Approved.



IN COMBINATION STARTERS—Rugged, simple construction of HCI is perfectly adapted to use as disconnect in combination starters.

SAFE LOAD BREAKING

with Unique "Arc-Quench" Action

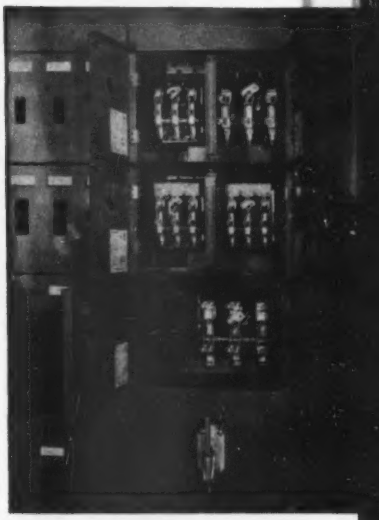
For the first time in a safety switch, magnetic repulsion is used to break load quickly, safely.

In Trumbull's HCI (High Capacity Interrupter) Type A switch, double-break contacts are projected and withdrawn with piston-like speed and force. The arcs repel each other and strike against grid pins, breaking into smaller arcs which cool rapidly.

The unique arc-quenching action provides safety, lengthens contact life by preventing pitting, and gives the switch much greater life expectancy. HCI withstands heavy short circuits without damage.

Its initial success as a safety switch has led to its adoption for use as disconnect in combination starters, control centers and switchboards.

Write for Bulletin TEC-10 which describes the HCI fully.



IN SWITCHBOARDS AND CONTROL CENTERS—Compact 30 and 60 ampere HCI switch interiors can be mounted in twin switchboard units (100 ampere HCI takes same vertical space), saving trough space and providing dependable short-circuit protection and sure ON-OFF handle indication.

TRUMBULL (T) ELECTRIC

DEPARTMENT OF GENERAL ELECTRIC COMPANY
PLAINVILLE, CONN.

Here's Varnished

Available types of American Varnished Cambric Cable

AMERICAN STEEL & WIRE DIVISION
USS
AMERICAN ELECTRICAL WIRE AND CABLE
UNITED STATES STEEL

CONDUCTORS:

Solid
Stranded
Extra-flexible
Annular
Segmental

BRAID FINISHES:

Weatherproof Wax
Flame and Moisture Resisting
U.R.C.
Slow Burning

OUTER COVERINGS:

Cotton Braids
Asbestos Braids
Lead Sheaths
Lead and Amerprene (Neoprene) Jackets

ARMOR FINISHES:

Flat Steel Tape
Interlocking Metal Tape
Steel Wire
Basket-weave

where to use

Cambric Cable

● When you design a cable installation, you usually end up making a choice between varnished cambric, paper or rubber insulation. To help you, here's a quick run-down on varnished cambric—as compared to rubber and paper.

LOAD CAPACITY AND HEAT RESISTANCE—Here, varnished cambric is in between paper and rubber insulations. In a 10 KV single conductor cable, maximum recommended copper temperatures are 81°C. for varnished cambric, 84°C. for paper, and 70°C. for special grades of rubber.

MOISTURE RESISTANCE—Varnished cambric may be used indoors in dry locations without a lead sheath while paper must always be protected by lead or some other form of moisture seal. Varnished cambric should not be used underground without a lead sheath, as its moisture resistance is not equal to rubber.

EASE OF HANDLING—Varnished cambric is easier to handle, simpler to install than paper; but it isn't as flexible as rubber.

OIL AND GREASE RESISTANCE—Varnished cambric may be used in contact with oil or grease. It is far superior to rubber in this respect and better even than Neoprene. Paper insulation must be protected with a lead sheath in which case the lead is of course resistant to oil and grease.

DIELECTRIC STRENGTH—Varnished cambric is better than rubber, but not equal to paper.

IN OTHER WORDS, varnished cambric is the *in-between* insulation for wires and cables. It is not likely to replace paper for high voltages and general power transmission. It can't equal rubber for flexibility and moisture resistance as needed by submarine and buried cables.

But for many installations, varnished cambric is the *only* insulation to use.

For example: If current carrying capacity is important, varnished cambric will generally replace rubber. It is frequently used where paper would seem to be the logical choice—because varnished cambric is so easy to install, terminate and join.

Perhaps the most common use of varnished cambric is for general power distribution within manufacturing plants . . . especially in heavy industries where large blocks of power are transmitted for short distances. Varnished cambric cables with rubber jackets are often used for bridges and other structures that need aerial cables. Here, we use rubber because a lead jacket would probably be ruined by vibration.

If you want to be *sure* that you're using the right insulation for your job, get in touch with our skilled engineers. For more information, write to American Steel & Wire Division, Rockefeller Building, Cleveland 13, Ohio.

U·S·S American Varnished Cambric Cables

USS

UNITED STATES STEEL COMPANY

AMERICAN STEEL & WIRE DIVISION, GENERAL OFFICES, CLEVELAND, OHIO
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

Type 1803-A

A-C Vacuum-Tube Voltmeter

Moderately Priced at **$155.00**

Moderately Priced

A-C Vacuum-Tube Voltmeter

with Many Operating Conveniences

The Type 1803-A Vacuum-Tube Voltmeter duplicates the performance of its pre-war predecessor, the popular Type 726-A instrument, at a price less than the latter and with many improvements including a smaller and completely shielded probe, a single zero adjustment for all ranges, a power supply not limited to a single frequency, and smaller and lighter construction.

This voltmeter is a peak-reading instrument with a straightforward circuit. It consists of a diode rectifier mounted in the probe, followed by a d-c amplifier and an indicating meter. The d-c amplifier uses a twin triode in a degenerative, balanced circuit.

The probe plugs into supports on the side of the metal cabinet, in which position the auxiliary test leads and terminals supplied with the instrument can be attached conveniently to the input connections.

The Probe *with its shielded case removed. Twin diode tube in probe has one section used to rectify the a-c voltage under measurement and another which balances the effect of the initial velocity current of the first. The d-c, balanced amplifier insures very little zero shift when line voltage varies*

Five Ranges Four scales cover the ranges from 0.1 to 150 volts a-c (full scale: 1.5, 5, 15, 50 and 150 volts)

Good Accuracy ±3% of full scale on all ranges for sinusoidal voltages, subject to frequency correction above 50 Mc; correction curve supplied

Wide Frequency Range without correction up to 120 Mc with maximum error of 10%; correction curve supplied

Single Zero Adjustment for all ranges

Equivalent A-C Input is a resistance in parallel with a capacitance; equivalent input capacitance of probe is 11 μμf; with plug connectors 12 μμf; equivalent parallel input resistance 7.7 megohms at low frequencies

Internal Calibration Control is a single adjustable resistor which corrects calibration if amplifier tube is changed

Auxiliary Connections supplied include a G-R double plug, pair of 30" test leads, pair of test prods and two alligator clips

Lightweight only 9¼ pounds

Write for Complete Data

ADMITTANCE METERS ☆ COAXIAL ELEMENTS ☆ DECADE CAPACITORS
DECADE INDUCTORS ☆ DECADE RESISTORS
DISTORTION METERS ☆ FREQUENCY METERS
FREQUENCY STANDARDS ☆ GEIGER COUNTERS
IMPEDANCE BRIDGES ☆ MODULATION METERS
LIGHT METERS ☆ MEGOHMMETERS ☆ VARIACS
MOTOR CONTROLS ☆ PRECISION CAPACITORS
NOISE METERS ☆ NULL DETECTORS ☆ OSCILLATORS
POLARISCOPES ☆ PULSE GENERATORS
SIGNAL GENERATORS ☆ VIBRATION METERS
STROBOSCOPES ☆ U.H.F. MEASURING EQUIPMENT
V-T VOLTMETERS ☆ WAVE ANALYZERS ☆ WAVE FILTERS

GENERAL RADIO Company

275 Massachusetts Avenue, Cambridge 39, Massachusetts

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Since 1915 – Designers and Manufacturers of Electronic Test Equipment

Since 1933..

ALLIS-CHALMERS 5/8% STEP VOLTAGE REGULATOR

CONSTANT IMPROVEMENT IN VOLTAGE REGULATION

Introduction of 5/8% step voltage regulation nineteen years ago by Allis-Chalmers has opened way for increasing customer satisfaction and utility profits

To improve the efficiency of voltage regulation and reduce costs, 19 years ago Allis-Chalmers introduced the first 5/8% step regulator. Until 1933, regulators then in use had been thought good enough. But Allis-Chalmers proved that better regulation could be provided.

After analyzing the problem, Allis-Chalmers engineers decided that a major improvement could be made in voltage regulation if a regulator could be built with thirty-two 5/8% steps. First the problem of applying tap-changing under-load equipment to conditions of frequent operation had to be solved.

And in the regulator introduced in 1933, Allis-Chalmers had the answer. The mechanism had stood up under 5,000,000 test operations — equivalent to 100 years of normal operation. Contacts had stood up under 2,000,000 operations under load — equivalent to 40 years of normal operation.

The new regulator showed impressive operating results: better regulation, lower losses, less maintenance, and lower cost than any regulator then on the market.

Best of all, now it was possible to build a regulator to handle high voltage circuits as well as the lower voltage circuits. The need for hundreds of feeder voltage regulators was eliminated.

This was just the first of many Allis-Chalmers innovations that improved regulation. Read the following pages for the complete story.

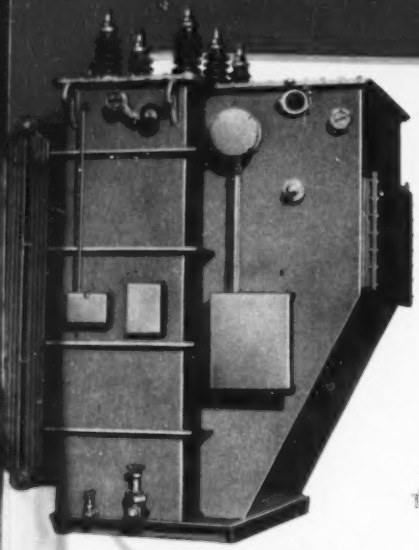
ALLIS-CHALMERS

Originators of 5/8% Step Regulators

A-3593

19 Years of 5/8% Step

GIVE YOU COMPLETE LINE OF FIELD



THREE-PHASE REGULATORS OFFER LATEST ALLIS-CHALMERS DESIGN FEATURES

Available in sizes through 69 kv, 2500 kva, Allis-Chalmers AFR regulators are equipped with LONG-LIFE CONTACTS made of non-burning metals for greatly reduced deterioration. HEAVY DUTY DRIVING MOTORS operate under oil and require no maintenance . . . they will withstand stalled current without injury. VOLTAGE INTEGRATION and "FEATHER-TOUCH" CONTROL provide better regulation under a variety of load conditions. SHOCK ABSORBING QUICK-BREAK MECHANISM operates on balanced spring principle to snub fast moving parts to standstill after a tap change is made. In units of 15 kv and below, UNIT CONSTRUCTION results in 78 fewer bolted connections and easier maintenance.

1933 1952

Nineteen Years of Developing Regulator "Firsts"— Many New Features Adopted by Entire Industry

Allis-Chalmers research did not stop with the introduction of the first 5/8% step regulator in 1933. Nearly every year since then has brought new features for the improvement of voltage regulation. Many of these new features have been adopted by other manufacturers in the industry.

Through its never-diminishing research, Allis-Chalmers has built an impressive record of "firsts." And new developments are being added to the list each year.

1933—First with 5/8% step regulation. Not only did Allis-Chalmers provide 5/8% step regulation first, but since 1933 Allis-Chalmers has been the only manufacturer to provide the advantages of 5/8% steps in all ranges. In 1941, 5/8% steps became standard in three-phase regulators.

1933 — First with Long-Life Contacts. Since 1933, all Allis-Chalmers regulators have been equipped with sintered RS-1045 arcing contact material to give hundreds of thousands of trouble-free operations. Not adopted by any other manufacturer till 1942.

1934—First outdoor-indoor universal regulator. A unit that permitted far more flexible installation. Adopted as standard in 1938.

1935 — First Voltage Integrating Time Delay. It actually integrates the voltage and causes the regulator to respond accordingly. Feature approaching this equipment not adopted by any other manufacturer till 1940.

1936 — First Oil-Sealed Inert-Gas System for High Voltage Regulators. Reduces maintenance. Not adopted by another manufacturer till 1949.

Originators of 5/8% Step Regulators

Regulator Development

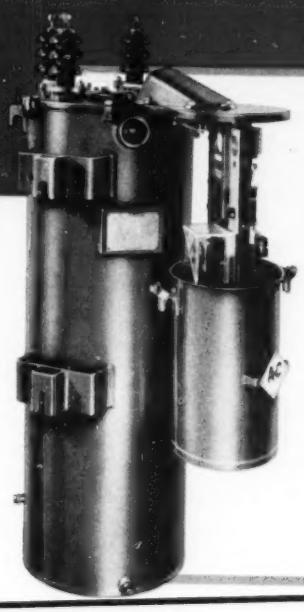
TESTED VOLTAGE REGULATORS

DFR REGULATORS PROVIDE COMBINATION OF QUALITY FEATURES FOR SINGLE PHASE

The *Vari-Amp* feature on the DFR regulator for single phase operation provides five operating ranges instead of the two ranges provided on other types of regulators. As loads increase ranges can be reduced in proportion —they don't have to be sliced in half.

Greater short circuit capacity is also available thanks to the *Vari-Amp* feature. And adjustment is greatly simplified since one man can change ratings in thirty seconds. No taping, bypassing, or changing of connections is required.

And don't forget the exciting current advantage of the 5/8% step regulator. Because 5/8% step regulators use only 1/8 the exciting current of other types, you get more KVA for useful load from existing capacity. 5/8% step regulators use no more exciting current than a transformer of similar rating.



EFFICIENT REGULATION AT LOW COST FOR FEEDER OR SUBSTATION APPLICATION

Allis-Chalmers JFR 5/8% step voltage regulator is available in ratings up to 50 amperes. The low price tag on this pole-type regulator makes it possible to bring the advantages of 5/8% step regulation to the smallest branch lines.

Like every Allis-Chalmers 5/8% step voltage regulator, the JFR regulator gives you ± 1 volt band, 20% range of regulation, easy control adjustment on the unit-type control, long-life contacts, fully automatic operation and low maintenance. Maintenance is simplified by the unit-type construction. To expose the control, it is necessary only to loosen two bolts and lower the control tank on a guide to a mechanical stop.

And to simplify installation, the JFR regulator is equipped with two jump-proof mounting brackets just like those used on distribution transformers.

1937 — First easily adjustable contact-making voltmeter. The voltage regulating relay has a simple rheostat for making voltage level adjustments and one movable contact for the band adjustment. Not adopted by any other manufacturer till 1950.

1938 — First Unit Control Panel. The first control panel designed specifically for a regulator.

1939 — First unit-type construction. AFR, DFR and JFR regulators employ unit-type construction in which both mechanism and transformer parts are combined in a unit assembly. In the AFR regulator this means 78 fewer bolted connections between tap changer and transformer — 78 fewer bolts to work loose in the field.

1940 — First *Vari-Amp* feature for DFR regulators. This feature greatly increases flexibility of DFR by providing five current ratings instead of the two current ratings obtainable from other types of regulators.

1941 — First with double terminal bushings. Solved problem of location of load and source bushings.

1942 — First with 1% accuracy control circuit.

1943-1945 — WAR YEARS (Development Postponed)

1947 — First Interchangeable Source and Load Bushings. Regulators can be installed to fit in any existing line structures.

1948 — First standard ratings for 2500 kva three-phase regulators. Not adopted by any other manufacturer till 1951.

1949—First thirty-two 5/8% step pole-type regulator. Brings advantages of 5/8% step regulation to branch lines.

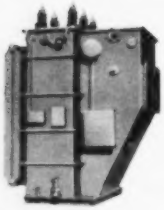
1951 — First Universal 15 kv three-phase regulator. Single unit has flexibility enough to operate over entire range from 11,000 to 14,400 volts. One regulator has more locations on a system.

Vari-Amp is an Allis-Chalmers trademark.

ALLIS-CHALMERS

7 Great Features

ALLIS-CHALMERS 5/8% STEP VOLTAGE REGULATORS



		AFR Three phase regulator, sizes through 69 kv, 2500 kva.	DFR Single phase regulator, sizes through 6900 v, 250 kva.	JFR Single phase regulator, 11.4 and 38.1 kva, 7620 v.
1	5/8% Steps	✓	✓	✓
2	Close regulation (±1 volt band)	✓	✓	✓
3	Easy control adjustment. The same type control used on all sizes	✓	✓	✓
4	Close average voltage (maintained by voltage integrator)	✓	✓	✓
5	Long life contacts of liberal design to withstand hundreds of thousands of operations	✓	✓	✓
6	Tap changing drive mechanism with balanced spring action to eliminate shock . . . operates under oil for long trouble-free life	✓	✓	✓
7	Unit construction to simplify your maintenance requirements.	✓	✓	✓

FOR ALL REGULATION JOBS — from an 11.4 kva regulator on a small feeder to the biggest 2500 kva three phase unit — Allis-Chalmers 5/8% step regulators provide all seven of the quality features checked off above.

That's why you can count on Allis-Chalmers for regulation that helps boost capacity, increase revenue, and improve customer good will.

In addition to these important advantages, the single phase 5/8% step regulators require only 1/3 the exciting current of older types of single phase regulators. The low exciting current releases system capacity for useful loads.

Get the complete facts on how Allis-Chalmers 5/8% step regulators can help you from your nearest Allis-Chalmers district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

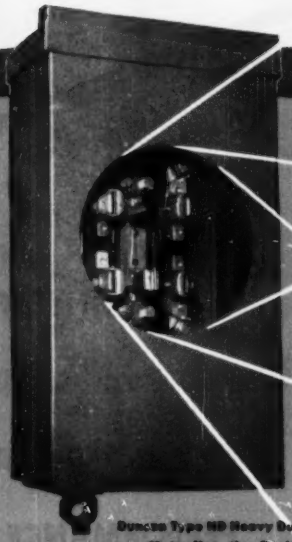
MILWAUKEE 1, WISCONSIN

LITHO. IN U.S.A.

the DUNCAN

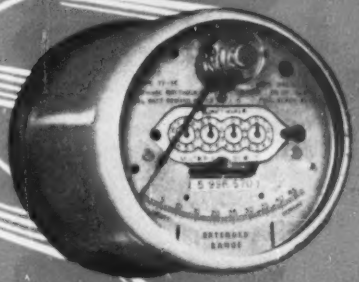
HEAVY DUTY FAMILY IS GROWING!

SELF-CONTAINED METERING OF LOADS UP TO 200-AMPERES

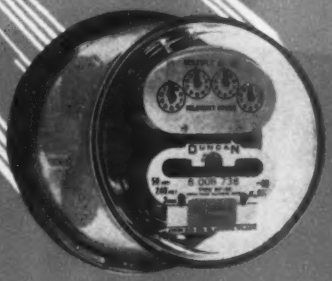


Duncan Type HD Heavy Duty Meter Mounting Device.

. . . For POLYPHASE 1-, 2-, or 3-phase 3-wire installations—The new Type MH-2S 50-ampere meter provides for accurate measurement of continuous load currents up to 200-amperes.



. . . For SINGLEPHASE DEMAND—The Type TF-5S 50-ampere, 240-volt, 3-wire singlephase watthour-thermal demand meter will provide accurate energy and demand readings to 200-ampere or 48 KW.

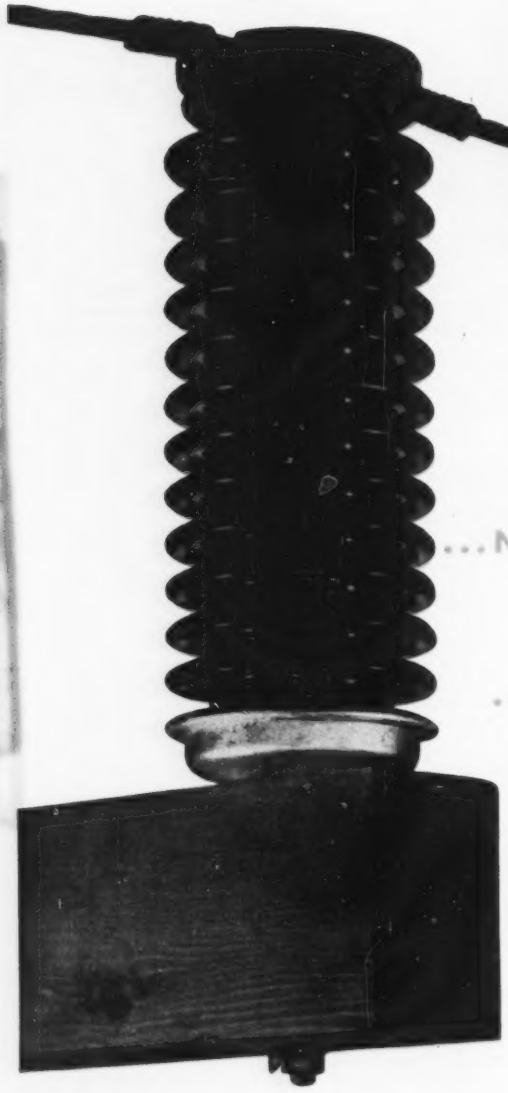


. . . For SINGLEPHASE—The Type MF-5S 50-ampere, 240-volt, 3-wire singlephase meter has capacity for accurate metering of continuous load currents up to 200-amperes.

THE DUNCAN family of Heavy Duty Equipment is continually growing in size and acceptance. By the elimination of current transformers for load currents between 100 and 200 amperes, appreciable savings are made in installation cost and mounting space. There is no better method of metering 1-, 2-, or 3-phase 3-wire services. Try these Duncan Heavy Duty combinations on your next installations in this capacity range.

makers of watthour meters for fifty years

DUNCAN ELECTRIC MFG. CO. LAFAYETTE, INDIANA



FOR

...NO RADIO INTERFERENCE

...NO CRACKING ...NO PUNCTURE

...GREATER RESISTANCE TO

...BETTER PERFORMANCE UNDER

...LOWEST REPLACEMENT AND

ISN'T IT TIME FOR YOU

20 YEARS...

...NO CLEANING

STONES AND BULLETS

ARCOVER

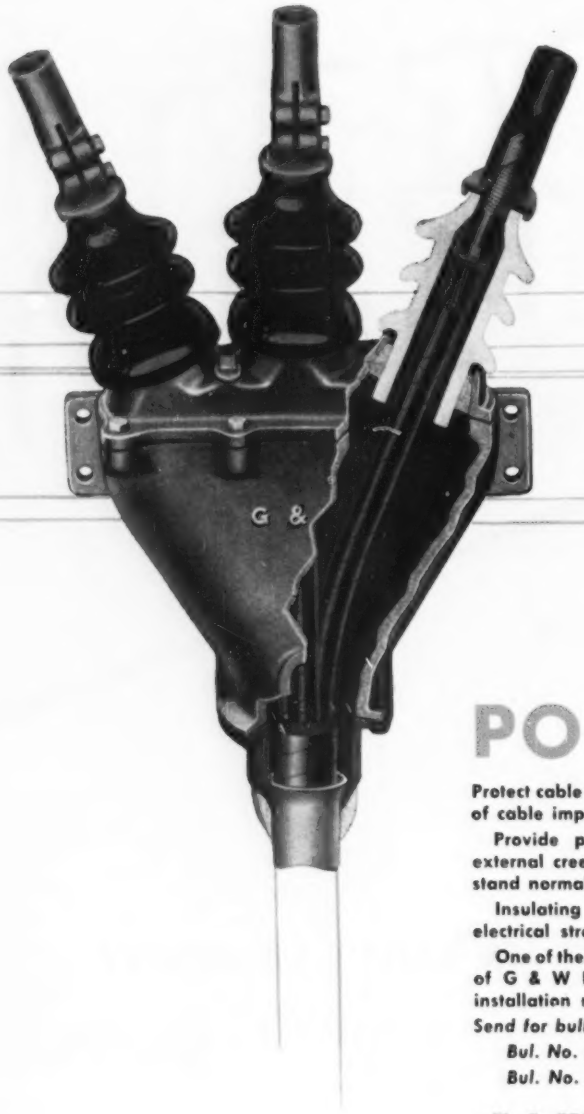
MAINTENANCE COST

TO STANDARDIZE ON LAPP LINE POSTS?

Lapp

LAPP INSULATOR CO., INC., LE ROY, N.Y., U.S.A.

PROPER SEALING AND TERMINATING OF HIGH VOLTAGE CABLES IS IMPORTANT. IT PAYS TO USE G & W POTHEADS... THE STANDARD OF THE INDUSTRY SINCE 1905.



G & W "FORETHOUGHT" AB-8 EXPLAINS THE THEORY OF STRESS RELIEF CONES AS USED IN POTHEADS. SEND FOR YOUR COPY, THERE IS NO OBLIGATION.

G & W ELECTRIC SPECIALTY

POTHEADS

Protect cable ends against moisture and leakage of cable impregnating oil.

Provide permanent porcelain internal and external creepage of adequate length to withstand normal and surge voltages.

Insulating compound in potheads improves electrical strength.

One of the hundreds of sizes, types and shapes of G & W POTHEADS will exactly meet your installation requirements.

Send for bulletins for complete data and prices:

Bul. No. AA50—Soldered porcelain type.

Bul. No. AB51—Capnut and other types.

G & W ELECTRIC SPECIALTY CO.

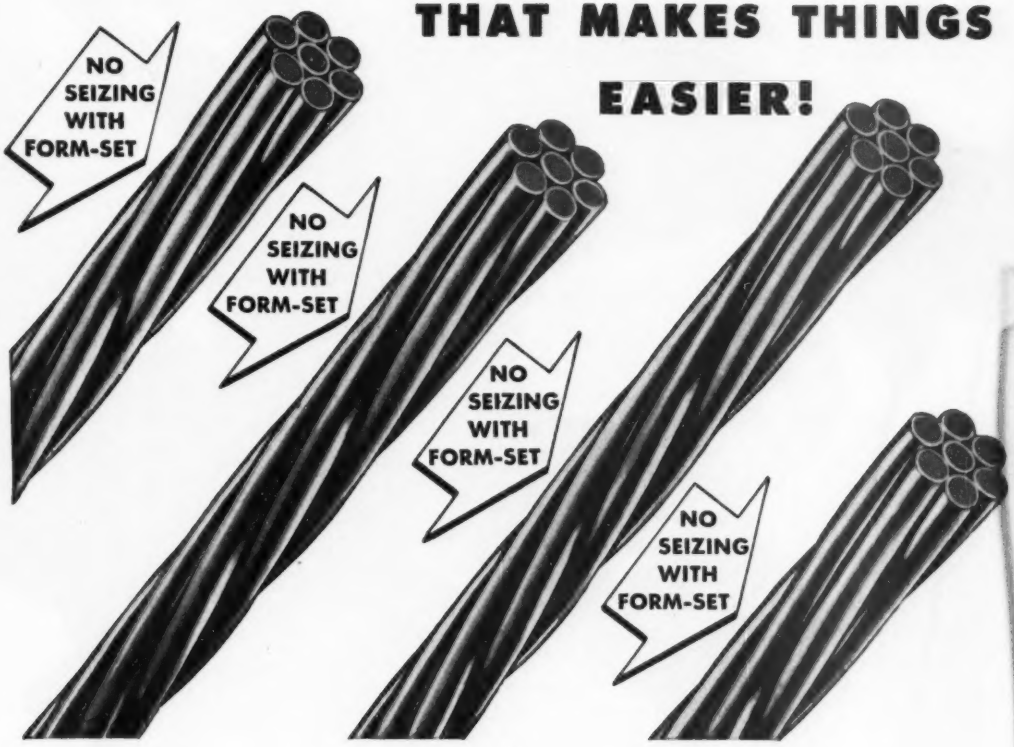
7780 Dante Avenue, Chicago 19, Illinois

Cable Terminating, Connecting and Sectionalizing Devices

Representatives in principal cities of U. S. A.

In Canada—Powerlite Devices Ltd. Toronto and Montreal

HERE'S THE *STRAND* THAT MAKES THINGS EASIER!



YES, IT'S A FACT. Any lineman using Form-Set strand will tell you that it makes things easier . . . makes the work go faster.

Reason: this is a strand that doesn't require seizing. Bethlehem Form-Set is preformed; that is, each individual wire is given its permanent helical shape before being laid in the strand with its neighbors. When Form-Set is cut, there is no forceful inner tension to drive the wires apart. They can't fly out in every direction. They don't spring up like a porcupine's quills.

Hence the strand slips easily and naturally into fittings; it doesn't have to be coaxed into place. No pinching of wires, no struggle, no time thrown away.

Form-Set is a strand that deserves the most careful consideration. Despite its advantages over nonpreformed types, it costs very little more . . . the difference is surprisingly small. Ask for information; it will be furnished promptly.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

Bethlehem *FORM-SET* Strand

CLEAN INSTALLATIONS. Individually mounted or grouped, wye or delta, whatever your standard wiring practice may be, you'll find it easy to design cleaner, safer installations with the new Westinghouse "CSP" Transformers.

Put Yourself ON THE SPOT

Where clearance means SAFETY

Put yourself in these shoes, high on a pole top where clearance means safety. That's where you'll appreciate the new Westinghouse "CSP"® Transformers with wall-mounted, high-voltage bushings that give you better working clearance—where they eliminate long loops that swing dangerously in the wind.

Try on these gloves, and you'll agree that it's important to have a large insulated knob to make hand-tightening easy, eliminating the need for tools.

Now back to the desk, where statistics talk best. Your own figures* can show you it's good business to standardize on "CSP" Transformers . . . to take advantage of this lower installed cost, better service continuity. Extra features like "Coastal Finish", bushings with unbreakable Enrup† knobs, and Wemco C-I (inhibited) Oil make it pay to specify Westinghouse "CSP" Transformers. J-70588

*If you have not yet made the detailed analysis of initial, installed and maintenance costs of "CSP" Transformers on the basis of *your own figures,* ask your Westinghouse representative for a copy of the check chart, B-4247B, "Transformer Costs and Their Relation to Profits". He'll be glad to give you details on the new product features, too. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

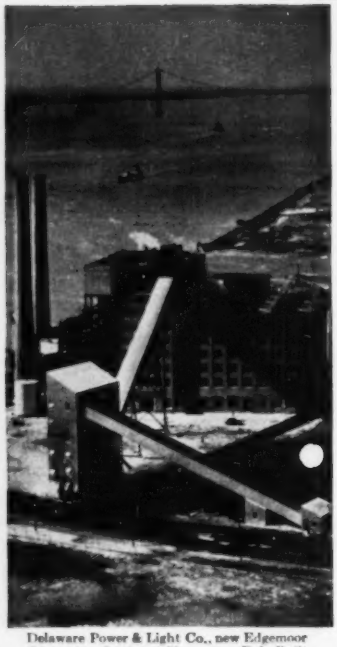
†T. M. Reg. U. S. R. Co.

YOU CAN BE SURE... IF IT'S

Westinghouse

"CSP" DISTRIBUTION TRANSFORMERS

One of two 60-cell, FME-17 Exide-Manchex Batteries providing emergency power in the Edgemoor Station.



Delaware Power & Light Co., new Edgemoor Generation Station, Wilmington, Del. Built by United Engineers & Constructors Inc.

DEPENDABLE POWER FOR THE DIAMOND STATE

Exide-Manchex BATTERIES

In the Delaware Power & Light Company's new Edgemoor Generation Station, near Wilmington, there are ninety-five 2.5 k.v. electrically operated circuit breakers, eight 12 k.v. pneumatically operated breakers, and a 5 k.w. inverter which supplies a.c. power for clocks, recording meters, and other instruments. And, in case of power failure, all this equipment operates efficiently and dependably on one of the two 60-cell FME-17 Exide-Manchex Batteries. The other battery provides for 9500 watts of emergency lighting.

The choice of Exide-Manchex Batteries for emergency power is a logical one, for in Exide-Manchex you get . . .

POSITIVE OPERATION: Dependable performance at ample voltage with no switching failures.

INSTANTANEOUS POWER: High rates for switchgear operation with adequate reserve power for dependable performance of all other control circuits and also emergency lighting.

LOW OPERATING COST: Extremely low internal resistance.

LOW MAINTENANCE COST: Water required about twice a year. No change of chemical solution needed during life of battery.

LOW DEPRECIATION: Sturdy, long-life construction.

GREATER CAPACITY in a given amount of space avoids overcrowding of equipment.

These features all contribute to the dependable performance of Exide-Manchex Batteries—help make Exide-Manchex *your best battery buy* for all control and substation services.

• • •

YOU GET ALL THESE FEATURES IN THE EXIDE-MANCHEX

- The *exclusive*, long-life manchester positive plate.
- Slotted plastic separators, impervious to chemical and electrical reaction.
- Plastic spacers for plate alignment.
- Latest development in molded glass jars.
- Heavy terminal posts with copper inserts for extra conductivity.

THE ELECTRIC STORAGE BATTERY CO.
Philadelphia 2

Exide Batteries of Canada, Limited, Toronto

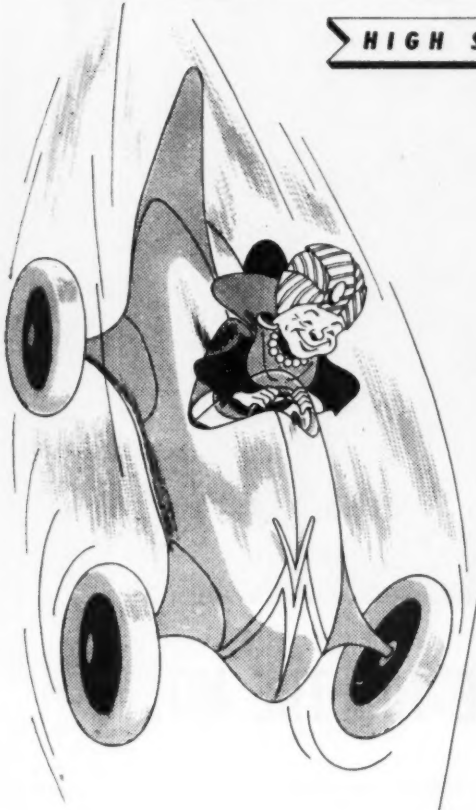
"Exide" and "Manchex" Reg. Trade-marks U.S. Pat. Off.

1888 . . . DEPENDABLE BATTERIES FOR 64 YEARS . . . 1952

Nothing stands up

like MICA under ●●●

HIGH SPEED and FRICTION



and

EXTREMES OF HEAT AND COLD

MOISTURE AND OIL PENETRATION

AGE AND OVERLOAD

when you think of MICA . . . think of MACALLEN

MACALLEN MICA

ALL FORMS, ALL QUANTITIES — ALL DEPENDABLE

THE MACALLEN COMPANY

16 MACALLEN STREET • BOSTON 27, MASS.

CHICAGO: 565 W. WASHINGTON BLVD. • CLEVELAND: 1231 SUPERIOR AVE.

What truck will SAVE YOU THE MOST?

The answer's a cinch! A truck that fits your job, of course. And that means a Dodge "*Job-Rated*" truck—one that's engineered at the factory for *your* kind of work.

In a Dodge "*Job-Rated*" truck, economy begins with the power plant—the right engine, operating with a high compression ratio for top gas and oil mileage. Maintenance costs are low, too, because a Dodge truck engine provides the proved advantages of such extra values as chrome-plated top piston rings and exhaust valve seat inserts.

In every phase of performance, you can depend on a thrifty Dodge "*Job-Rated*" truck to give you more for your money. You'll get greater braking safety, easier bad-weather starting, sharper turning for easier handling, extraordinary cab comfort, and smoother riding.

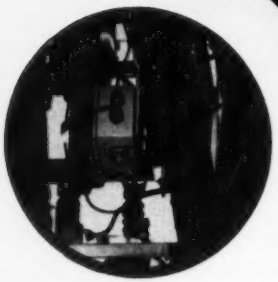
And you can get gyrol Fluid Drive on ½-, ¾-, and 1-ton models. This remarkable Dodge *exclusive* gives you smooth, "cushioned" power for easier driving—less wear on truck and tires—safer bad-weather operation—longer truck life. Ask for a demonstration.

For help and advice on the truck which will save you the most, see your nearby Dodge dealer.

DODGE "Job-Rated" TRUCKS

All in ONE NEAT PACKAGE Ready to install!

LESS THAN $570 PER KVAR IN 300 KVAR SIZE, INCLUDING SWITCHES! AND CONSIDER THE SAVINGS IN INSTALLATION TIME AND MAN-HOURS!



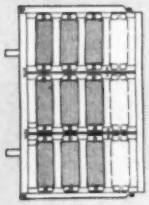
Terminal box for control wiring, readily accessible from the pole. Upper photo shows two 225 kvar switched racks being hooked up.

Hang it up . . . hook it up . . . and the job is done! That's how you make your *first* savings, in time and labor.

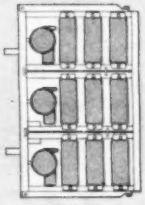
Then you *go on saving*, because this is a low-cost switching arrangement. It reduces the number of substation installations. You can put L-M Capacitor Assemblies farther out on the line, where they will do the most good. They are available in 225 and 300 kvar, switched or unswitched.

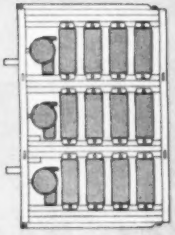
These packaged assemblies come completely crated and padded. No damage to painted surfaces; no maintenance painting after installation. To install, merely remove four bolts to release assembly from skid. A handy lifting yoke is available without charge.

Manufactured in these 3 assemblies



5 kv Racks: up to 225 kvar Switched; 225 or 300 kvar Unswitched





2.4 to 15 kv Rack: up to 300 kvar Switched

All Components Are L-M Manufactured

SWITCHES are L-M's standard heavy-duty Kyle type GR, for remote control, rated 100 amperes at 15 kv. *TERMINAL BOX* has removable cover making it easy to connect control cable before rack is removed from skid, or after mounting. *RACK* is heavy angle steel, with high factor of safety in its rugged design. Every *ELEMEX CAPACITOR* and component individually tested, as is the completed assembly . . . *at the factory*. *CONTROLS* not included, but fully automatic control may be provided with L-M's Voltage Sensitive Control.

GET THESE BULLETINS

Your L-M Field Engineer will gladly supply complete information and bulletins; or write Capacitor Division, Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

LINE MATERIAL Elemex Capacitors

Complete Coordinated Equipment for Distribution Today

73-8

L-M's *New* Non-Reclosing Attachment for Kyle® Reclosers

GIVES GREATER SAFETY FOR MEN AND EQUIPMENT... GREATER SAFETY IN HOT LINE WORK

L-M's new Non-Reclosing Attachment provides lockout of the recloser on the first fast operation. Should an accidental contact or arc occur while men are working on the line, the recloser opens instantly and stays open, instead of continuing through the usual complete four-operation sequence.

This new attachment provides the same protection out on the line that has been available only on substation breakers. It permits hot line work with far greater safety to men and equipment. The attachment is available at a small extra cost on all Kyle reclosers.

For complete information ask the L-M Field Engineer or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

72

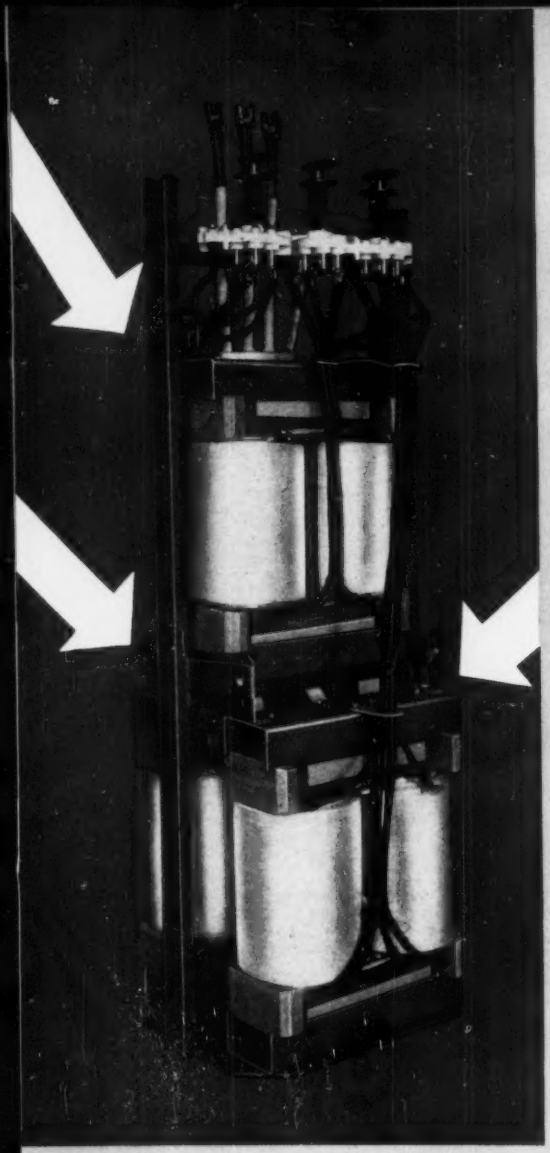
The Non-Reclosing Attachment lever is under the sleet hood next to the regular reset handle. Pulling down the lever puts the attachment into operation but *does not* open the line. When work is completed the lever is pushed back up—and the recloser will then operate normally.

LM®

LINE MATERIAL

Kyle Reclosers

Complete Coordinated Equipment for Distribution Today



Three single-phase core-coil assemblies, one above and two below, for simplified mounting and best cooling. Rigidly held in strong channel-steel frame which fits into steel channels welded inside tank wall.

It's easy to replace any one unit in L-M 3-PHASE ROUND WOUNDS®

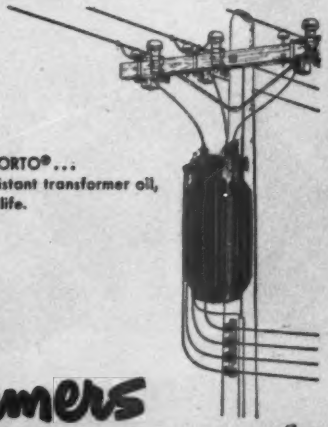
L-M Round-Wound transformers have exceedingly high impulse strength and overload capacity so that burnouts are extremely rare. But if a coil *should* burn out, you don't have to replace the whole transformer. The core-coil assembly from any one phase is simply removed from the rack and a replacement unit quickly installed.

It's as simple as that, and almost as quick . . . whether it's done in your own shops or in one of the authorized L-M Transformer Service Shops near you.

Under emergency conditions you can restore service in a hurry because with L-M construction you can connect two units in open wye or delta.

Besides the advantages of rapid core-coil replacement and fast service restoration, L-M 3-phase transformers give you all the desirable Round-Wound performance features . . . with the wound core that isn't cut or disturbed in any way after annealing . . . with the round coils wound right onto the core. An L-M "exclusive!"

Get the whole story. Ask the L-M Field Engineer or write Line Material Company, Transformer Division, Zanesville, Ohio (a McGraw Electric Company Division).



Now furnished with ORTO® . . . L-M's oxidation-resistant transformer oil, inhibited for longer life.

LM®

LINE MATERIAL Transformers

Complete Coordinated Equipment for Distribution Today

can't rattle!
L-M's new
GUY WIRE
PROTECTOR
clamps guys firmly
can't twist!
1. Good tight anti-rattle hooks grip any strand from ¼" to ½" firmly and permanently.
2. Body is 18-gauge steel, heavily L-M hot-dip galvanized to assure long-lasting protection.
3. Rounded edges add rigidity and safety. No rough edges to cut hands or snag clothes.
4. Long 30-inch cutaway at bottom permits putting the protector over anchor rod and two 6-inch clamps—a unique L-M feature.
5. Bottom clamp conveniently tightened with bolt on the side of protector. Grips any size from ¼" strand to 1" anchor rod. No loose parts to fall out.

L-M guy wire protectors offer extra features for safety and savings. Large size, fully rounded design, and bright L-M galvanizing assure high visibility. Design speeds up the installation. Generous, easily accessible clamping assures a firm grip — it's almost impossible for the protector to rattle or rotate. In 7′ and 8′ lengths.

74

LINE MATERIAL

Line Construction Materials

Complete Coordinated Equipment for All Distribution Requirements

FOR FULL INFORMATION on these and other L-M Line Construction Materials, ask the L-M Field Engineer—or write Line Material Company, Milwaukee 1, Wis. (a McGraw Electric Company Division).

L-M's Expanding Anchors

now redesigned to give you

✓ FASTER INSTALLATION!

✓ GREATER HOLDING POWER!

✓ AT NO INCREASE IN PRICE!

Blades closed.

Partly expanded. Spreader arms push blades out easily—no binding.

Fully expanded.

L-M has redesigned its steel expanding anchors to give you easier installation, and greater holding power.

Expanded area is increased 10 to 15%—which means more holding power in any kind of soil.

Spreader arms are heavier and stronger. These improvements, together with a new hinge arrangement, completely eliminate binding. Tamping is much easier, installation is faster.

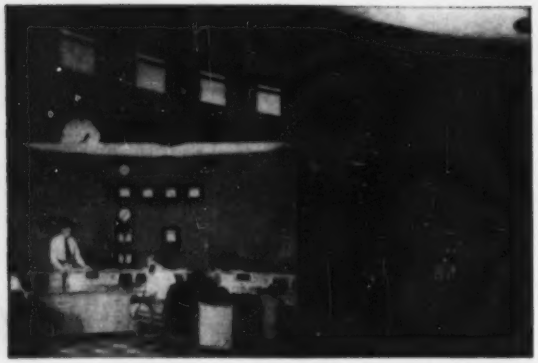
As the tamping block strikes the tamping collar, the strong spreader arms give the steel blades a sliding action that cuts into the surrounding soil quickly and easily.

These anchors are 8" in diameter when fully closed and are available in two-way, three-way, or four-way designs, for ⅜", ½", and ¾" anchor rods.

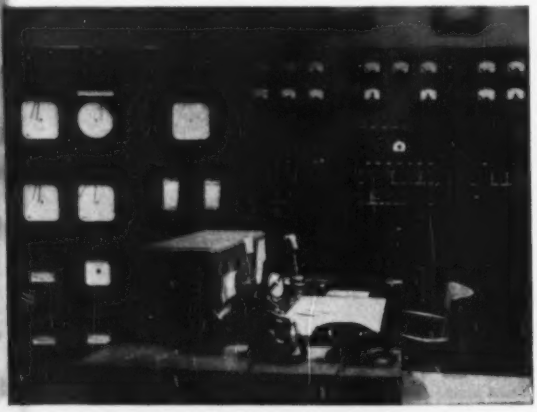
For complete information on these and other L-M Line Construction Materials, ask the L-M Field Engineer, or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

LINE MATERIAL *Line Construction Materials*

Complete Coordinated Equipment for Distribution Today



METAMETER AT BONNEVILLE AND GRAND COULEE DAMS. Bristol strip-chart Metameters are used by the Bonneville Power Administration. The receivers shown above are installed on the Bonneville dispatcher's board at the H. D. Ross Substation, Ampere, Washington, and record Bonneville 230 KV, Bonneville total power, Coulee total power (transmitted from Grand Coulee Dam approximately 250 miles away), and system total power.



METAMETER AT ROCKLAND LIGHT AND POWER COMPANY, MIDDLETOWN, N. Y. The 15 Metameter indicating receivers at right show kilowatts, water levels and kilovars at three hydro-electric power plants. The three at left measure and record pressure of delivered gas, and integrate flow into the Company's distribution system at points up to 50 miles away. The other Bristol instruments totalize flow during a given period of time in the three supply lines and also give a continuous reading and a chart record of total instantaneous flow through all three lines.

DISPATCHING MADE EASIER

Bristol Metameter* telemeters give the dispatcher up-to-minute readings of electrical and other measurements made many miles away

A complete and continuous visual picture of what is happening at key points throughout the system enables the dispatcher to accurately appraise conditions instantly and act with full knowledge.

With information from his Metameter receivers, he can keep in touch with load changes and direct the generation and transmission of power more economically and with greater ease. He can foresee emergencies and take the necessary steps to maintain schedules. Often, he can increase safe maximum loads in tie lines considerably.

Among the types of information Bristol Metameter telemeters make available to the load dispatcher are: the load at each tie-line point, output of each generating station, totalized output (on one instrument) of all generating stations, active and reactive power and power demand at key points, voltage and current at various points.

Generating stations use Metameter for information on output of each associated station (attended or unattended), total output, water level and water wheel gate position, water level in reservoirs, surge tanks, etc.

Readings can be transmitted any distance, over any two-wire circuit or its equivalent, carrier-channel, telephone, telegraph or radio (including microwave) . . . to recording receivers (narrow or wide-strip chart or round chart) or indicating receivers.

Metameter is the tried-and-proved telemetering system. Thousands are in use on all types of service. Write us for Bulletin M1700. THE BRISTOL COMPANY, 116 Bristol Road, Waterbury 20, Conn.

Reg. U. S. Pat. Off.

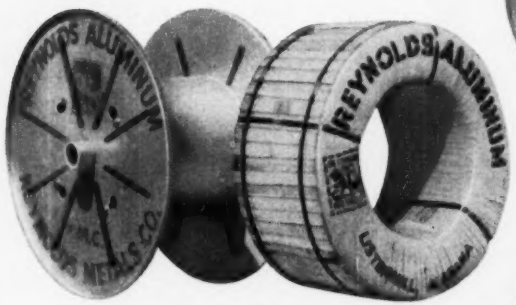
BRISTOL

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

NOW 4 Reynolds Master Reels Do the Work of 100 Wooden Reels

Handle ACSR quicker, more economically
Eliminate inventory and exchange

Almost every cable user wants to convert to the modern Reynolds ACSR Master Reel and Coil system. And no wonder! These smart operators eliminate *all* problems connected with wooden reels. The Reynolds Master Reel eliminates handling, storing, record keeping, as well as cutting damage cost to a minimum.



Reynolds Master Reel and Coil are easily assembled by linemen right on the job.

Reynolds Master Coils hold the same amount of conductor as conventional wooden reels. The cable is carefully waterproofed, lagged and banded—completely protected against rough handling. The Reynolds Master Reel is all metal, quickly taken apart and put back together around the Master Coil. It is far sturdier than a wooden reel and can be used over and over again.

Find out about this revolutionary method of solving your cable and reel problems. You will cut your costs with this time- and money-saving cable handling method.

Reynolds Master Reel and Coil save time, money, labor —are sturdier than wooden reels.

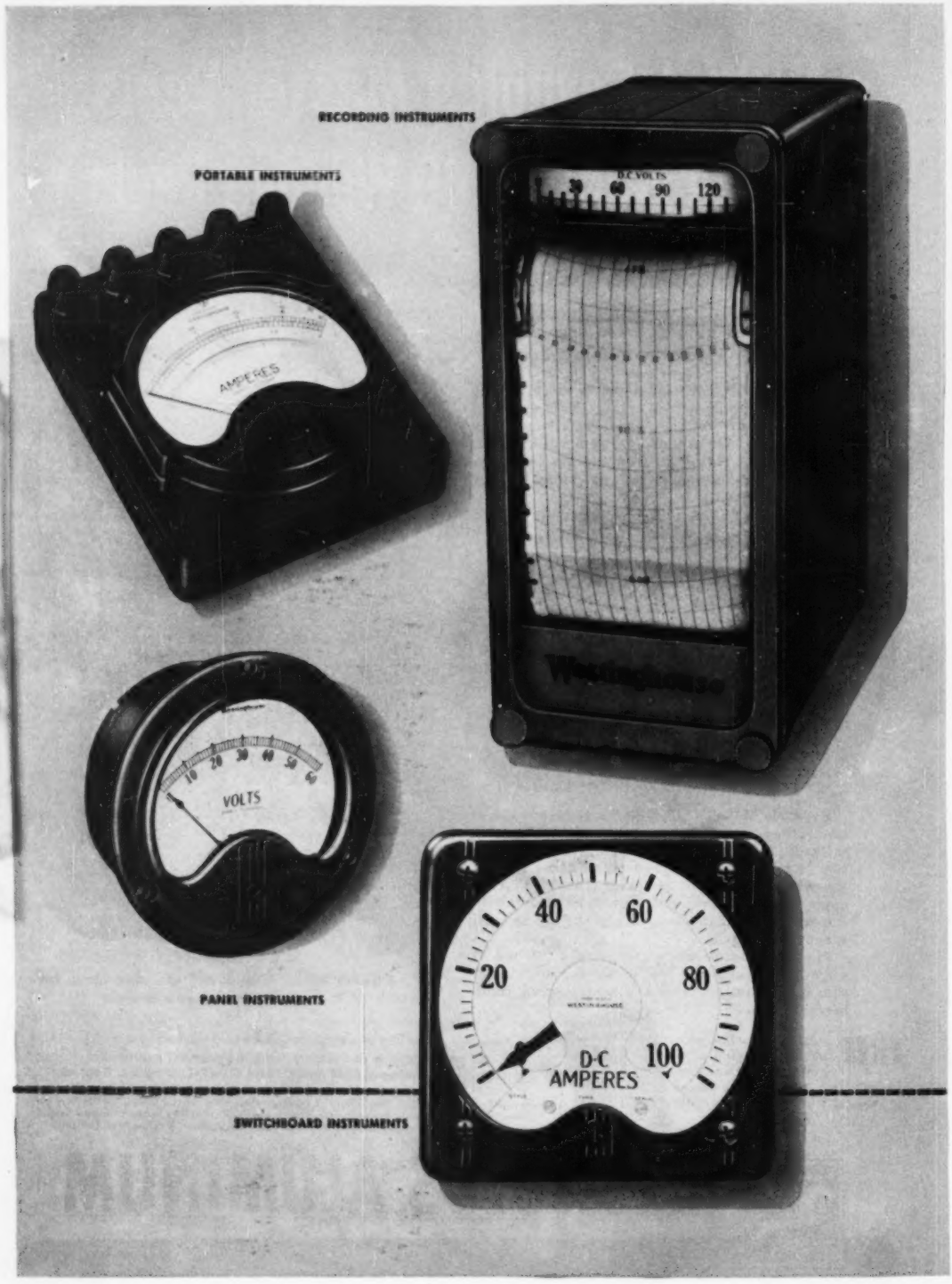
FREE ACSR MANUAL FOR ENGINEERS CONTAINS COMPLETE INFORMATION, CHARTS AND TABLES. Please request this booklet on your business letterhead.

For Complete Information
see your Reynolds distributors listed below or write direct to
Reynolds Metals Company, 2584 South Third Street, Louisville 1, Kentucky.

Westinghouse Electric Supply Co., New York, N. Y. (And branches) • North Coast Electric Co., Seattle, Wash. Griffin Manufacturing Co., Dallas, Texas • Southern Electric Supply Co., Houston, Texas • Williamson Sales Co., Shreveport, Louisiana (And branches) • California Electric Supply Corp., San Francisco, California

REYNOLDS METALS

REYNOLDS ALUMINUM


RECORDING INSTRUMENTS
PORTABLE INSTRUMENTS
D.C. VOLTS
30
60
90
120
AMPERES
VOLTS
10
20
30
40
50
60
PANEL INSTRUMENTS
40
60
20
80
D-C
AMPERES
100
SWITCHBOARD INSTRUMENTS

Only a *complete line*

answers *all your* electrical measuring requirements

The case of Mastic Tile Corporation demonstrates how the complete line of Westinghouse Instruments holds answers to your electrical measurement problems.

Mastic's problem was one of predetermining load on a Banbury Mixer motor in order to facilitate the operator's job and speed the mixing cycle. It was answered by the standard Westinghouse GY-40 Recording Wattmeter with proper choice of scale, current and potential transformers, and chart speed. In fact, so well did this standard instrument accomplish its job that final results show—a 15 percent reduction in mixing cycle time along with the elimination of damaging surge shocks which can now be anticipated and prevented by the machine operator.

Westinghouse will continue to give you a wider selection for every need . . . whether it be a-c or d-c current and voltage, single or polyphase circuits, watts or vars, frequency, power factor, synchroscopes, temperature indicators, ground detectors or synchrotie. You get assurance of quality too, because every applicable instrument . . .

Meets A. S. A. Performance Requirements!

All Westinghouse Instruments are built to meet the rigid performance requirements of the American Standards Association. No more exacting guarantee of an instrument can be made. And you get . . .

Competent Application Assistance!

Westinghouse Instrument Application Engineers are available to help you in selecting and applying the proper instruments for your application. Simply call your nearest Westinghouse office.

For complete information about Westinghouse Instruments write for Booklet B-4696, address: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-40407

YOU CAN BE SURE... IF IT'S Westinghouse

INSTRUMENTS

For your

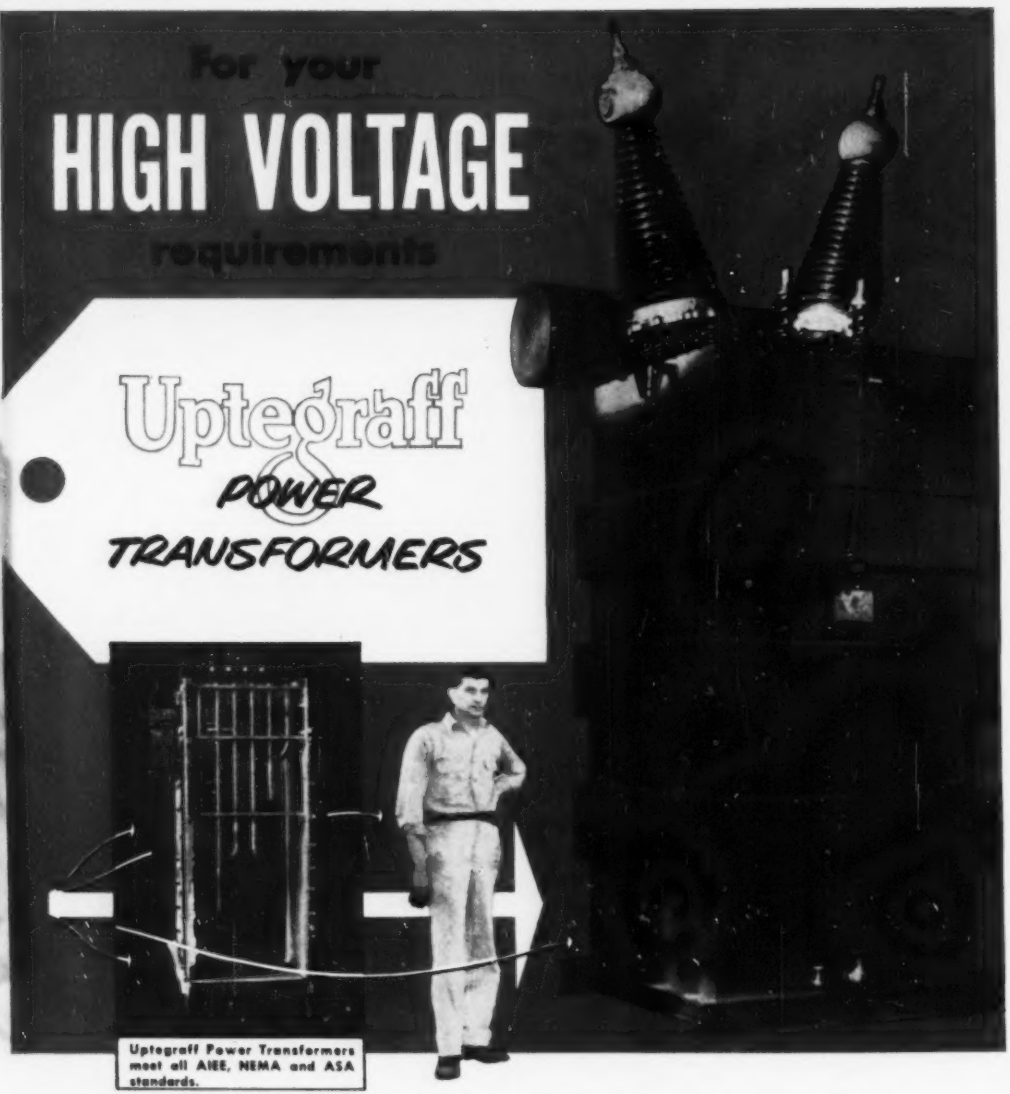
HIGH VOLTAGE

requirements

Uptegraff

POWER

TRANSFORMERS



Uptegraff Power Transformers meet all AIEE, NEMA and ASA standards.

Built to meet standard or special requirements, Uptegraff High-Voltage Power Transformers are made in sizes through 10,000 KVA, for use on all voltage systems through 115 KV.

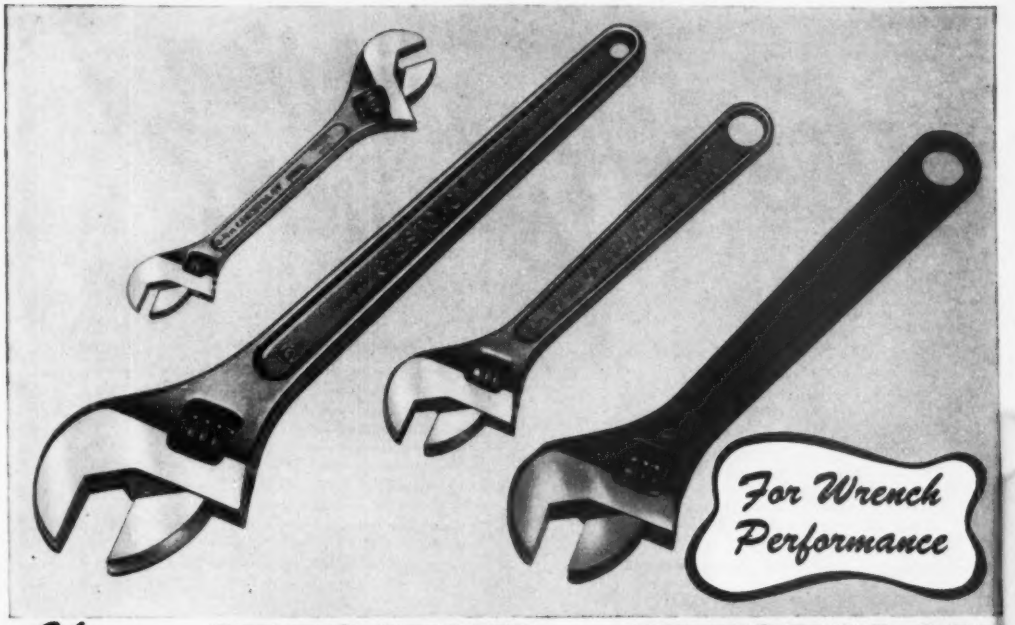
Among the important construction features that contribute to long life and safe operation are: strong, rigid tanks, designed to withstand full atmospheric pressure for vacuum filling; radiators designed for ready access for cleaning and painting; synthetic rubber-impregnated cork gaskets, with gasket stops to prevent over-compression; positive-positioning tap changers with high-compression contacts; shot-blasted tanks finished with three coats of lasting paint.

Uptegraff offers complete engineering, manufacturing and testing facilities, including 1.5-million volt impulse generator now being installed.

We will be glad to have your inquiry for High-Voltage Power Transformers built to meet your particular needs.

R · E · UPTEGRAFF MANUFACTURING CO. SCOTTDALE PENNSYLVANIA

Makers of POWER · DISTRIBUTION · INSTRUMENT · SPECIALTY TRANSFORMERS



Choose CRESCENT or CRESTOLOY

● Since more Crescent and Crestoloy Adjustable Wrenches are sold today than any other brand, an explanation of the differences in these two famous Crescent tools may be appropriate.

CRESTOLOY Wrenches are forged from a special alloy steel permitting thinner, trimmer design with greater strength and less weight than conventional types. They are available in Single End patterns, 4″ to 24″ size. Double-end in four models combining 4-6; 6-8; 8-10; 10-12 inch sizes.

The 15″, 18″ and 24″ sizes, available in Single End pattern only, are distinguished by their tapered handles. There is no stronger or finer Adjustable Wrench than CRESTOLOY.

CRESCENT Wrenches are forged from selected carbon steel and specially heat-treated to increase their toughness and durability. Due to their lesser cost and relatively great strength, they are widely used in industrial and service operations where thinness is not essential. Available in Single End Patterns, 4″ to 18″.

Both Wrenches represent the best in design and workmanship, and carry the same guarantee.

GET YOUR FREE COPY!
This new 20-page booklet provides many useful how-to-do-it ideas for both amateurs and professional mechanics, as well as basic information on the proper selection, use and care of hand tools. 93 illustrations. Write today.

CRESCENT TOOLS
Give Wings to Work

Sign of the Artisan
Symbol of Excellence

Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK

The only question is "when?"

Sooner or later the man looking for a better truck buys an International.

Then he wonders why he didn't do it sooner. He gets better performance, he cuts costs, he makes more money.

If that's what you want, the only question is "when?"—when are you going to see your International Truck Dealer or Branch and get all the facts about the new International Truck that is engineered to do your job better, at lower cost?

INTERNATIONAL HARVESTER COMPANY • CHICAGO

Only Internationals give you—

- All-truck engines designed exclusively for truck work, developed and built in the world's largest exclusive truck engine plant.
- The "roomiest, most comfortable cab on the road"—the Comfo-Vision Cab designed by drivers for drivers.
- Super-steering system—more positive steering control with easier handling and 37° turning circle for greater maneuverability.
- The traditional toughness of trucks which have been first in heavy-duty truck sales for 19 straight years.
- The world's most complete line of trucks . . . 115 basic models, from ½-ton pickups to 90,000 lb. GVW off-highway models.
- Service by nation's largest exclusive truck service organization.

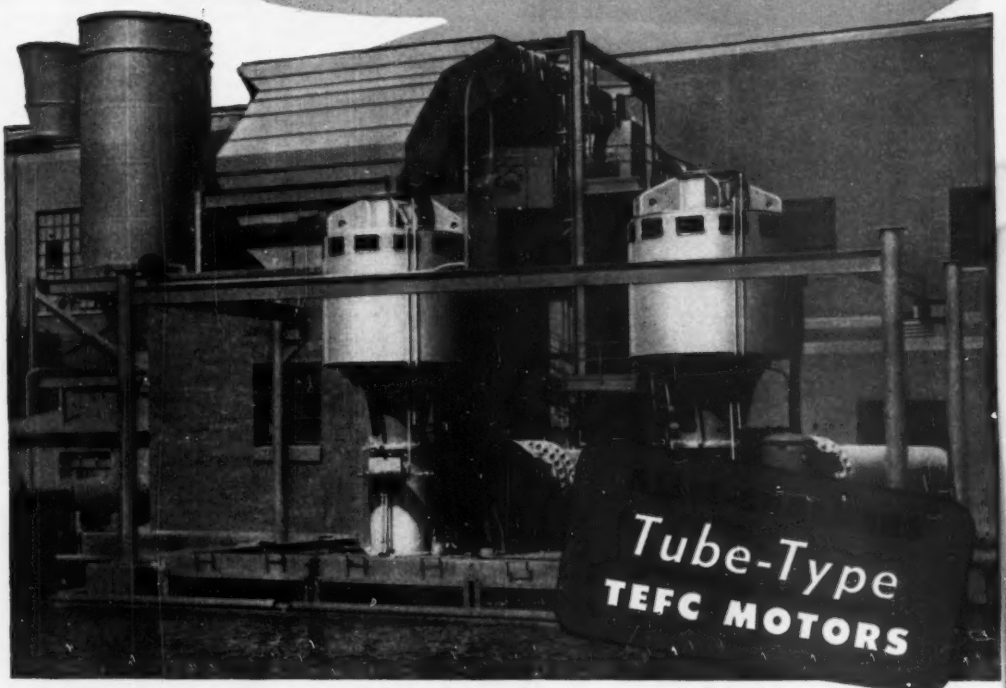
International Harvester Builds McCormick Farm Equipment and Farmall Tractors . . . Motor Trucks . . . Industrial Power . . . Refrigerators and Freezers

INTERNATIONAL TRUCKS

More than One Million Now on the Road

Model L-120, 127 inch wheelbase, special utility body, 5,400 pounds GVW.

Open Sky
IS ALL THE ROOF THEY NEED



● Southwestern Public Service Corporation's installation of Allis-Chalmers 400-hp, 870-rpm vertical tube-type TEFC motors driving Allis-Chalmers pumps at Amarillo, Texas.

What does it cost to house a motor? Nothing — if it's an Allis-Chalmers *tube-type* totally-enclosed fan-cooled motor. Then the sky is roof enough. And it need not be blue sky either.

These motors aren't afraid of fog, rain, snow, salt, coal dust, soot, alkalies, or mild acids in the air. They're built to take care of themselves . . . and to save you money. The opportunity for low installation cost is only the beginning. Peak reliability and low maintenance pay worth-while dividends throughout the long life of the motors.

Why? Because their *tube-type* air-to-air heat exchanger design offers you these advantages:

1. *Self-cleaning action* . . . result of generous flow of outside air through smooth, straight cooling tubes.
2. *Complete enclosure* . . . protects stator core and other electrical parts from dirt and corrosion.
3. *Full internal air circulation* . . . provides efficient, even cooling—makes large sizes practical.

These are proved advantages, for purchases have exceeded 170,000 hp in sizes from 250 to 2500 hp. Introduced in 1946, *tube-type* motors are now available down to 40 hp at 600 rpm.

Bulletin 05B7150 describes these motors that are equally at home indoors or out. Call your A-C representative, or write to Allis-Chalmers, Milwaukee 1, Wisconsin. A-3534

Also available in horizontal designs.

ALLIS-CHALMERS

ACSR—First "Line" of Defense

TODAY, in order to meet critical defense needs, more and more aluminum is going into power transmission.

This recognition of aluminum electrical conductor is supported by its overwhelming acceptance by the power industry—today, more than 80 per cent of all transmission lines being built are aluminum.

For these dollars-and-cents reasons: Lower material cost compared with copper. The strength-ratio weight of aluminum electrical conductor cuts installation costs by making possible longer spans, less sag, lower towers. Its great corrosion resistance means long life, less maintenance costs. Less corona cuts power loss. And reserve capacity can be built in at lower cost.

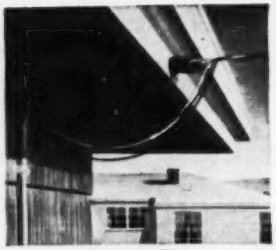
Our service engineers will gladly work with you on your conductor problems!

65 Kaiser Aluminum offices and warehouse distributors in principal cities. Kaiser Aluminum & Chemical Sales, Inc., Oakland 12, California.

Also distributed by: General Electric Supply Corporation, Line Material Company, Mine & Smelter Company, Tafel Electric and Supply Company, Westinghouse Electric Supply Company.

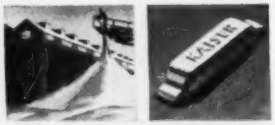
Kaiser Aluminum

Setting the pace . . . through quality and service



OTHER COST-SAVERS! Kaiser Aluminum triplex service drop cable combines three wires in one assembly—needs fewer accessories. Kaiser Aluminum Weatherproof Wire—neoprene or polyethylene covered—also offers cost and operating economies.

HIGHEST QUALITY—Our production personnel have had long experience in cable making, employ the finest new production facilities. Cable is tested by the most modern instruments.



DEPENDABILITY—Our continuing supply of conductor is based on completely integrated facilities—from bauxite to finished ACSR.

TECHNICAL ASSISTANCE—For help on your conductor problems, call any Kaiser Aluminum office. It's listed in your local classified telephone directory.

A CONTINUING PROMOTION

To step up demand for this new 3-way indirect lighting

Modernize old table lamps this easy, low-cost way!

You'd never think you could make an up-to-date lamp like the one above out of an old table lamp! But you can—in only a matter of minutes and for under $3!

All it takes is a Monowatt "Improv-a-lite" lamp wiring unit and General Electric's new R-40 3-lite bulb. The new G-E bulb gives a pleasing balance of up and down light, and your choice of 150, 100, or 50-watts at the flick of the switch.

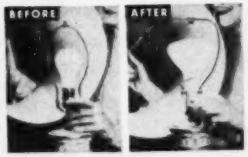
Doing the job is easy. Remove old socket and wire, pull new wire through lamp, screw on 3-lite socket. Then slide wire into plug, press down lever, and it's ready for use.

Want a free booklet? "How to Wire Lamps" gives tips on bringing old lamps up to date. For booklet, or to learn where you can buy "Improv-a-lite" units if not yet available where you shop, write The Monowatt Dept. of General Electric, 95 Hathaway St., Providence, R. I.

You can put your confidence in—

GENERAL ELECTRIC

Easy, low-cost way to have 3-way indirect lighting in your old table lamps



In just minutes, you can convert your old table lamps to give you indirect lighting with three brightness levels! General Electric's new R-40 3-lite bulb, plus Monowatt adaptor kit, transforms your lamps as shown above—gives pleasing diffused light and choice of 150, 100, and 50-watts at the flick of a switch.

Using the special new Monowatt "Improv-a-lite" unit, you simply remove socket and wire, pull new wire through lamp, and screw on 3-lite socket. Then slide wire into plug, press down on lever, and it's ready for use!

To learn where you can buy "Improv-a-lite" units and R-40 bulb, if they are not yet available where you shop, write The Monowatt Dept. of General Electric, 95 Hathaway Street, Providence, R. I.

FREE BOOKLET—*gives tips on modernizing table lamps. For your copy of "How to Wire Lamps", write to address above.*

You can put your confidence in—

GENERAL ELECTRIC

MORE ADVERTISING SUPPORT

Ads like these will appear in Better Homes & Gardens, American Home, Popular Mechanics and Popular Science, starting in February.

Demand for General Electric's new R-40 3-lite bulb and Monowatt Lamp Wiring Kit keeps *growing*. And no wonder! With this combination, your customers can quickly convert old table lamps into modern, indirect-lighting lamps—*at low cost.*

Moreover, continuing *promotion* by the G-E Lamp Division and Monowatt Department is constantly *creating* demand. Be sure you have G-E R-40 bulbs and Improv-A-Lite Kits on hand. Take full profit-advantage of this advertising and merchandising support.

Send for this brochure . . . gives you suggestions for developing a complete R-40 Improv-A-Lite promotion program, including:

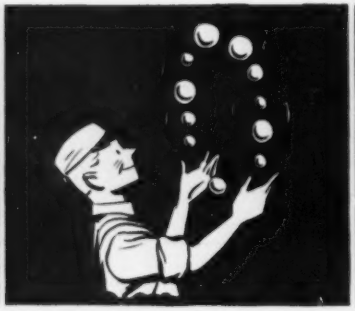
• Counter and Window Displays • Consumer Booklet "How to Wire Lamps" • Newspaper Ad Mats • Motion Picture • Television and Radio Spot Announcements • Publicity Releases • Envelope Stuffers • Catalog Sheets. See your Monowatt or G-E Lamp Supplier. Or write Lamp Division, General Electric, Nela Park, Cleveland 12, Ohio; or Monowatt, Providence 7, R. I.

You can put your confidence in—

GENERAL ELECTRIC

LINE UP for low-cost steam...
with the B&W Type E Pulverizer

Five B&W Type E Pulverizers, serving a B&W Radiant Boiler of 800,000 lb. per hr. steam capacity.



RECIRCULATING LOAD – DRIES AS IT GRINDS

Recirculation of fines within the mill gives repeated, quick-drying contact with large masses of heated air and metal... produces proper fineness at all loads, even with coal as wet as it can get. Fines are classified in the mill.

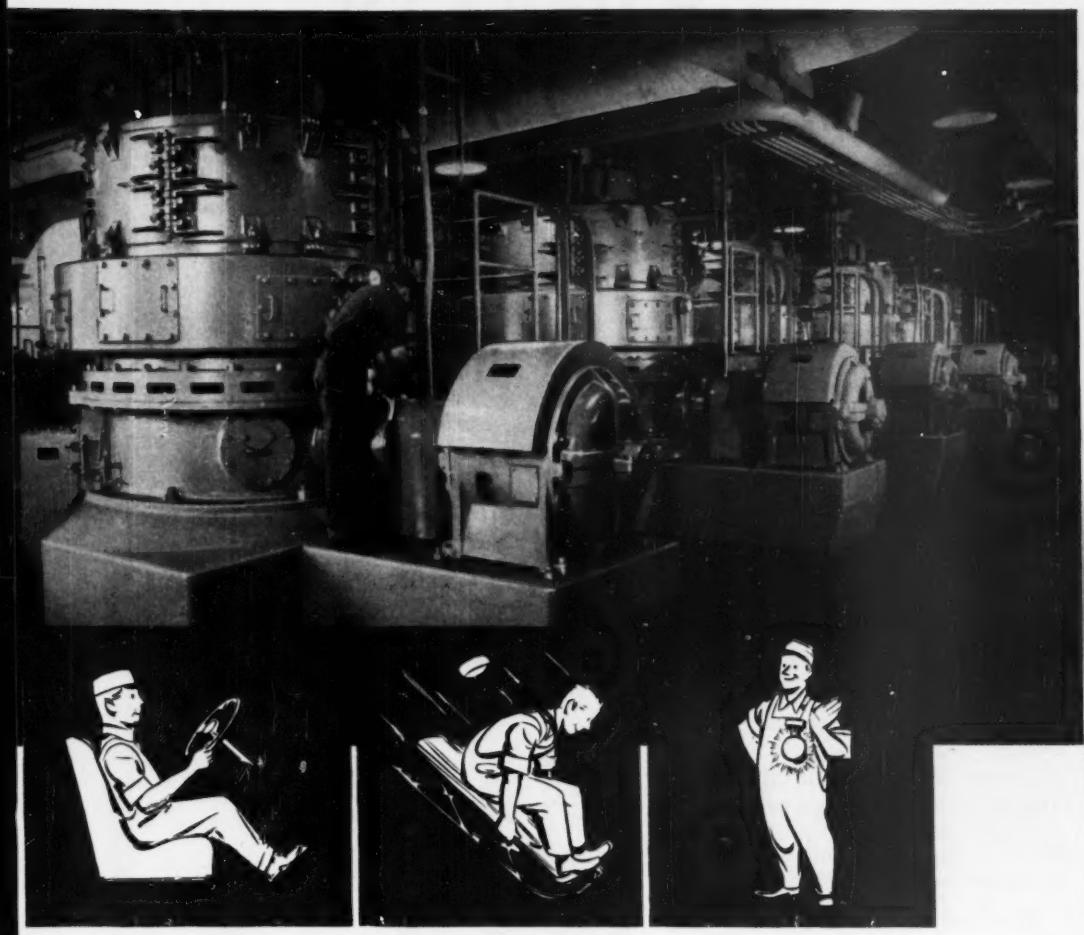
UNIFORM PERFORMANCE REGARDLESS OF WEAR

Balls and grinding rings wear together... assure uniform fineness regardless of attrition of the grinding elements . . . fineness automatically increases at reduced loads.

BLOWS CLEAN AIR – SAVES WEAR AND TEAR

Unique in pressurized operation, the Type E Pulverizer requires remarkably little maintenance of the primary fan, because it blows only clean air . . . is not subject to the damaging abrasion of entrained particles.

Bulletin G-57 illustrates and describes the design, construction, operating and maintenance features of the Type E Pulverizer. Write: The Babcock & Wilcox Company, 85 Liberty Street, New York 6, New York.



ONE-POINT VARIABLE FUEL-AIR CONTROL

Like the accelerator on your automobile . . . assures proper coal-to-air mixture . . . produces desired rate of steam generation over a wide range with coal conditions suitable for sustained high combustion efficiency.

LOW POWER CONSUMPTION

Ball-and-ring grinding, anti-friction bearings, pressure lubrication, and automatic rejection of ungrindable materials make possible high output with minimum power demand.

OUTSTANDING PERFORMANCE RECORD

Availability and maintenance economy beyond today's most exacting requirements are proved in over 1300 Type E Pulverizer installations.

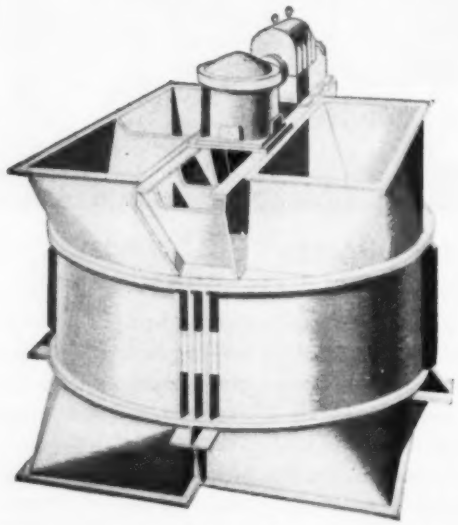
Helping Industry Cut Steam Costs Since 1867

BABCOCK & WILCOX

G-9041

...preheater fuel costs ...s of plants!

The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves the heat is transferred from the waste gases to the incoming cold air.



The Ljungstrom air preheater has proved its value in industrial and utility plants throughout the country. That is why every year a constantly increasing percentage of the installed boiler capacity is equipped with Ljungstrom air preheaters.

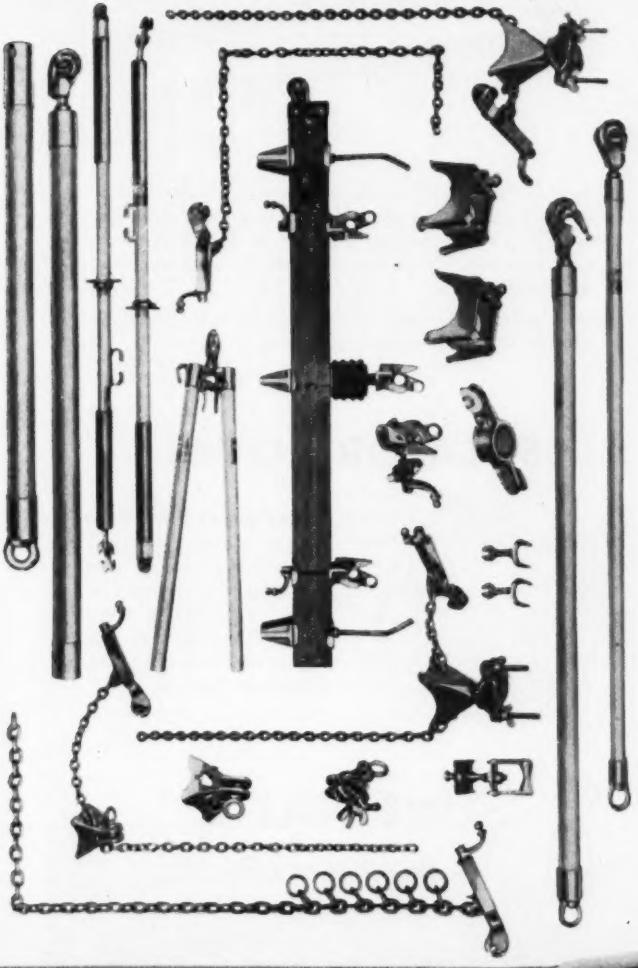
Your fuel costs will be lower too, when your boiler is equipped with the Ljungstrom air preheater. The regenerative design of the Ljungstrom permits reliable operation at low exit gas temperatures. This assures the greatest possible heat recovery . . . reduces the amount of fuel required.

If you are planning a new installation, or expanding your present one, our engineers will welcome the opportunity to show you how the Ljungstrom **air preheater can raise the overall** efficiency of *your* plant.

THE AIR PREHEATER CORPORATION

60 East 42nd Street, New York 17, N. Y.

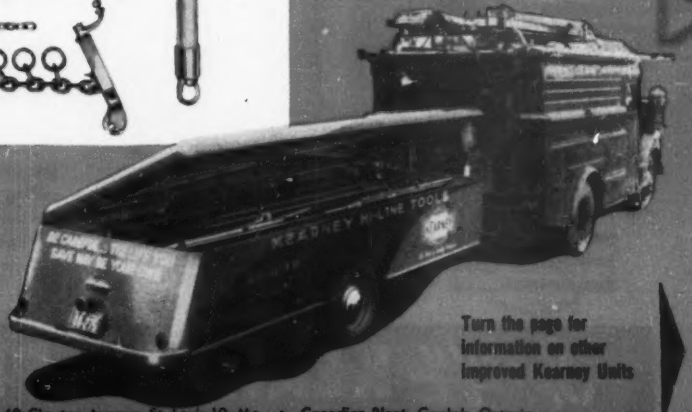
KEARNEY
Hi-LINE TOOLS *Provide*
MAXIMUM PROTECTION *plus* REDUCED OUTAGES



For many years Kearney Hi-Line tools have been the industry's standard for safety and efficiency in live-line maintenance. Now with the addition of the improved plastic covered hotsticks, Kearney tools are better than ever. These new sticks are multiple laminated Douglas fir, covered with a 1/16" jacket of tough hi-dielectric plastic.

The periodic drying and refinishing required with varnished wood sticks is not necessary with the new Kearney plastic covered pole — nor is a special "dry box" required for storing them. Plasticks are not only safer — they are more damage resistant — they last longer.

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO.



New Streamlined TOOL TRAILER

The new redesigned Kearney Hi-Line trailer provides greater storage area and, just as important, improved tool accessibility. It features increased "roadability" and maneuvers easily with any type truck. A built-in forced air electric heater keeps tools in dry working condition even in humid climates.

Turn the page for information on other improved Kearney Units

JAMES R. KEARNEY CORPORATION • 4224-42 Clayton Avenue, St. Louis 10, Mo. • Canadian Plant: Guelph, Ontario

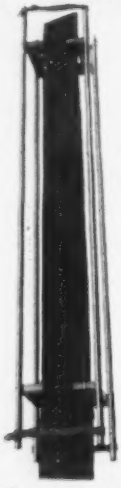
Specify KEARNEY PRODUCTS for BETTER CONSTRUCTION SAFER MAINTENANCE

for GREATER SAFETY

TO THE LINEMAN, USE THESE IMPROVED

Hi-LINE TOOLS

New Kearney POLE GUARD



These Pole Guards are used to keep lines clear of a new pole when setting the new pole between hot conductors. Available in one piece — or spliced poles. The spliced poles fold to ½ their working length for easier storage and transportation.

LINE GUARDS

New One-Piece Construction

These new guards, of one-piece construction, are simpler and safer to install and are exceptionally strong. The plastic is not brittle — and is exceedingly difficult to crack or chip. It has extra high insulating qualities which do not decrease — will not absorb moisture.

These guards can be used on conductors up to and including 336,400 C.M. ACSR over armor rod clips.

INSULATOR COVER

For use with line guards shown above, this sturdy plastic molded unit is strong enough to resist damage if dropped from pole — yet sufficiently light in weight (2 to 3 pounds depending on size) to be easily handled when installing.

LINE PULL-R

Will Pull or Lift from ANY Position

With the Kearney light-weight LINE PULL-R, you save time and money on the multitude of pulling and lifting operations encountered in line construction and maintenance. Available in capacities from ¾ to 6 tons. Write for bulletin 18-45.

Specify KEARNEY PRODUCTS

HOOK STICK

This revolutionary new spring operated SAF-T-CLAMPSTICK eliminates the use of external operating mechanisms, thus making hot line tap clamp installation simpler and quicker. Only a quarter-turn of the pole is required to install and remove eye type clamps. With a high dielectric strength of 75,000 volts per foot, these sticks are available on hinged or straight poles with or without rainshields.

Figure 1. With the hook unlocked a quarter-turn of the clampstick pole is the only operation necessary to draw the hook and clamp eye screw into the recessed clampstick head. A strong steel spring holds the clamp rigidly for installation on the conductor.

Figure 2. After the clamp is placed on the line, a light pull on the stick pulls the eye screw out of the recessed head just far enough to permit a swivel action between hook and screw during tightening.

Figure 3. To remove the clampstick after tightening the clamp, the hook is pulled all of the way out of the head and given a quarter-turn. This locks the hook in the open position for removal from the clamp eye.

JUMPER CLAMP

This new development in jumper clamps has a threaded recess which receives the threaded stud installed on the end of the jumper cable. The stud is swaged to the flexible cable, then screwed tightly into the jumper clamp head. These jumper clamps are now available for use on lines up to 500 MCM.

Kearney recommends that these jumpers be ordered "made-up" with cable from the factory.

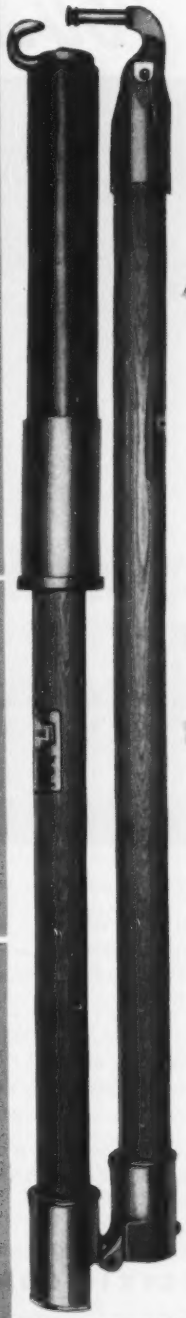
PLATFORM

Now made with multiple laminated Douglas fir, this new platform is stronger and provides surer footing for the lineman. For use on wood poles, round steel poles or angle iron tower legs. All platforms treated with special wood PRE-SER-VOR.

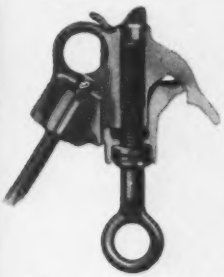
Ask your Kearney Salesman for more specific information — or write for catalog pages

JAMES R. KEARNEY CORPORATION

4224-42 Clayton Avenue, St. Louis 10, Mo. Canadian Plant: Guelph, Ontario



CLAMPS



For all line tap connections the improved protected thread Con-nec-tap clamp does the job better. The operating screw travels in a grease filled chamber, thus keeping the unused portion of the threads clean and insuring easier operation of the screw. Available in sizes for use on conductors from No. 6 solid copper to 800 MCM stranded copper.

STIRRUPS

Kearney's new line of stirrups incorporates the standard Con-nec-tap clamps with a special stirrup bail installed on the clamp at the point where the tap wire is normally connected. These stirrups are available with conventional clamps or with the protected thread design, in a range of sizes from No. 8 stranded to 400 MCM for use on conductors of any metal.

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO.

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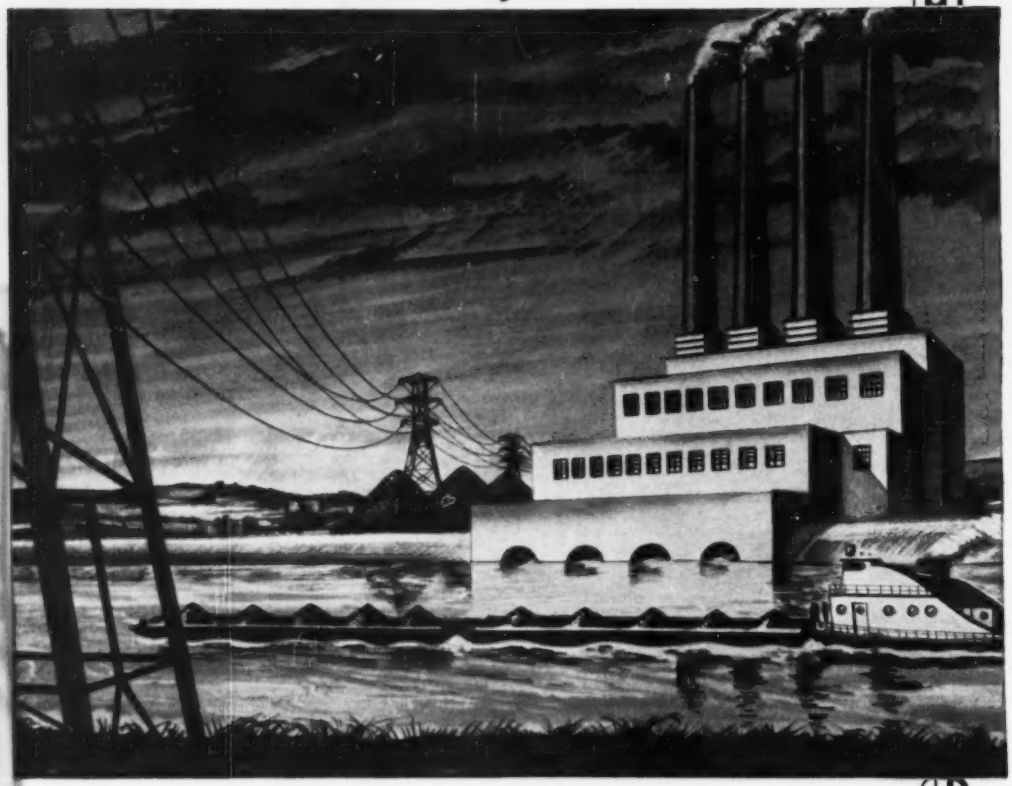
For BETTER CONSTRUCTION — SAFER MAINTENANCE
Through Constant Field Research and Engineering

Between YOU and your Customers



BASICALLY it's service . . . your obligation to supply energy to meet their needs. To do this there is also between you and your customers . . . the transformer and regulating equipment.

To be sure that your service is what it should be . . . your transformers should be Moloney Transformers. Why? Because your customers want power . . . without interruptions . . . and you want to supply it efficiently and economically. Moloney Transformers can help you do this because of their record of better performance, more reliability and lower maintenance cost.

Whatever your transformer problems . . . Moloney has, or can design, equipment to solve them. So, for "between *you* and your customers" . . . *specify Moloney.*

M872-9

MOLONEY ELECTRIC COMPANY

Manufacturers of Power Transformers • Distribution Transformers • Load Ratio Control Transformers Step Voltage Regulators • Unit Substations

MOLONEY ELECTRIC = BETTER PERFORMANCE, GREATER RELIABILITY, LESS MAINTENANCE

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS, MO. AND TORONTO, ONT., CANADA

EDITORIALS

American Power Conference Leads the Way

Top American engineering and management talent has few opportunities to compare experiences and discuss problems except within the confines of individual organizations. Even fewer opportunities are open to lower management levels to hear from outstanding electrical industry executives. One might ask, on what national forums are management's varied problems and opportunities for improvement the featured portion of programs.

The American Institute of Electrical Engineers has been struggling with its committee on management. Each year more and more effort has gone into this activity with little in the way of tangible results. An annual gathering of engineering and operating men from utilities under the sponsorship of Edison Electric Institute is visualized by certain members. But this constructive idea is making little progress. There are some signs that the annual meeting of EEI will soon begin to fill more of the utilities' needs in the way of discussions of management problems and sound methods of solution. The regional groups like the Southeastern Electric Exchange, Pennsylvania Electric Association, and Pacific Coast Electrical Association have made much progress in this direction. All of these activities need wide support so as to assure constructive gains in this field.

Another group has now taken a larger share of leadership at the national level. The Midwest Power Conference, sponsored by Illinois Institute of Technology, is this leader. This year when the Midwest Power Conference convenes March 26, it will be under the name, American Power Conference. In addition to the cooperating schools and societies in the Midwest, it will have the support of Edison Electric Institute and the Association of Edison Illuminating Companies.

This first meeting of the American Power Conference is also being held during the year of the 100th anniversary of the founding of the American Society of Civil Engineers. The conference will devote some of its general sessions to the Centennial of Engineering which will be held in Chicago during 1952.

The conference program will contain an outstanding array of speakers including George Gadsby, president of EEI; Pressly N. McCance, president, AEIC; Philip Sporn, president, American Gas & Electric Co; N. Bernard Gussett, president, Iowa Power & Light Co; Edwin Vennard, vice president, Middle West Service Co; Leland I. Doan, president, Dow Chemical Co; William J. Grede, president, National Association of Manufacturers; James J. Nance, president, Hotpoint, Inc; Edward J. Doyle, vice-chairman, Commonwealth Edison Co; Chester E. Lang, vice president, General Electric Co; and P. H. Powers, president, West Penn Power Co.

We congratulate the Illinois Institute of Technology on its leadership. We hope that the American Power Conference will live up to its name. It will surely stimulate others toward more constructive management-engineering conferences.

Keep Niagara for Private Development

On Aug 15, 1950, the proponents of public power threw down a challenge to the electric utility industry in the form of the Lehman-Roosevelt bill for federal redevelopment of Niagara Falls. Except for the appearance of Niagara Mohawk Power Corp in opposition to the bill and in favor of private development, the serious challenge went unanswered until shortly before a Senate subcommittee opened hearings last August on the project. Sen Homer Capehart, Rep, Ind., took under his wing the bill for private development proposed by Rep William Miller, Rep, New York. And five power companies in New York interlocked arms and decided to fight for private development and their own existence.

The companies struck their first blow with the announcement of a booklet which sets forth their case for redevelopment by private enterprise. But compared to the task which must be done, this was merely a token action. The New York utilities are going into this fight without much home support. Not only have both Senators from New York proposed bills for public development, but also the New York legislature has declared for public power. Furthermore, the New York power quintet does not face the usual court battle with some governmental agency over the legality of an FPC license. Their row to hoe is the fact that redevelopment of the Niagara by any group cannot proceed without an act of Congress, a provision inserted in the 1950 enabling treaty with Canada by Senator Lehman for the benefit of public power.

Thus, the case for private development cannot be fought and won by the five New York utilities acting alone. It remains for every leader and every member of the electric utility industry, both individually and through their associations, to get the facts to the public and to Congress. Even though the proposals for redevelopment won't be acted upon until the next session of Congress, time is growing short, and the public power group will not be idle.

A forceful and wholehearted program of truthful and stimulating information must be mapped out and delivered to the public and its representatives in Congress. And the entire industry must get into this fight.

The Swiss Do It—Why Can't We?

The Swiss have come up with a handy way of day-marking overhead wires near airports to warn pilots. Where airports lie in valleys near high tension lines, wires are marked with hollow yellow spheres hung along them at intervals of about 150 ft. The spheres are light weight aluminum shells, about 20 in. in diameter. In the 15 years they have been used, no trouble has been experienced with wind, ice collection, electrical disturbances, or faulted conductors. The yellow spheres not only serve as obstruction markers, but they are also used by pilots as a way to locate the airports.

With the increase in use of airplanes for various business and agricultural purposes, the problem of daytime marking of utility transmission and distribution lines is becoming increasingly important.

We have no record of the number of transmission or distribution lines that have been knocked out or broken or how many outages have been caused by airplane damage. But according to the Flight Safety Foundation, Inc, there were 288 reported cases of collisions with wires and poles during 1950 in non-aircarrier flying alone. About 88% occurred in daylight and about 20% near established airports.

In the majority of cases the pilots are not to blame. The wires are usually installed along roadways. They are extremely difficult to see—especially where the spans are long, and the poles are also unmarked, which is usually the case. Where lines have been knocked down repeatedly, even though they were below the established glide angle limits, some power companies have gone to considerable expense to lower or reroute them or to place them underground.

Utilities may find it advantageous to start marking their lines in airport approaches. The Swiss marking scheme may offer a solution.

Nudging Nearer to "Cold" Light

Another step—possibly a long step—has been made towards realization of "cold" light as a practical means of illumination. E. Newton Harvey, Princeton University, reported it at the recent annual meeting of the American Association for the Advancement of Science.

Previous knowledge had it that light emitted by living organisms was the work of two complex chemicals, one of them a catalyst acting on the other. Now there have been isolated new types of chemicals that are capable of producing light by simple exposure to the oxygen of the air.

There remains now the task of synthesizing these chemicals and producing them in quantity at low enough cost. How long will that take? No one knows. But we would not advise anyone to sell utility stock in anticipation of decline in revenue from loss of the lighting load.

Let the Losers Celebrate

Winners in EEI prize award contests usually put on a dinner or other kind of party for employees of the department concerned. All is jollity and merriment. Everyone feels proud of having a part in the great accomplishment and is inspired to do even better in the days ahead. Such occasions do much to uplift and maintain spirit and morale.

But the losers. Do they put on parties for the people whose work was considered so good as to merit entry in competition? No, of course not. They lost, didn't they? What have they to celebrate?

Actually they have more to celebrate than the winners. "To travel hopefully is better than to arrive, and the truest success is to labor," said Robert Louis Stevenson. That's what they have to celebrate—that winning is ahead if they keep on trying. But the folks on whom the trying depends are not much inspired to greater effort when their work gets no more recognition from the boss than the dismal news of losing.

We suggest that every company entering an EEI competition arrange a party for the employees concerned. Win or lose, they are the same people, no better for having won, no worse for having lost. Except that, having lost, their spirit is dampened if the boss does not indicate his pride in them for having tried.

THE ELECTRICAL WEEK

Featured in The News

Morehouse Committee tells Manly Fleischmann electric utility industry's three-year, 30 million-kw expansion program is too conservative (p 76) . . . **Thomas C. Buchanan** appointed chairman of the Federal Power Commission (p 78) . . . **National Production Authority** official says street lighting modernization can go on (p 80) . . . **William J. Clapp** is named president of Florida Power Corp (p 84).

• • •

In his annual message to the Legislature, New York's Gov Thomas E. Dewey says this about the Niagara and St. Lawrence projects: "We are still being blocked by a stubborn group of Washington officials some of whom seem determined that all hydroelectric power developments in the country must belong to the federal government . . . State of New York is ready, willing, and able to proceed with these great developments for cheap power without cost to any taxpayer—state or federal."

Los Angeles Department of Water and Power will celebrate 1952 as "Golden Anniversary Year" of city-owned water and power projects, starting with a week-long celebration Feb. 4 and an elaborate pageant Feb. 6.

Anchor rocks, weighing from 8 to 16 tons each are being placed on the banks of the Columbia River immediately below Coulee Dam in an attempt to prevent slides and settling caused by rapid changes in tail water level (EW, Dec. 3, p 96). Operations of the Coulee power plant have been restricted to a tailwater variation of 2 ft in any eight hours, in addition to the original restriction of 4 ft in any 24 hour period.

New ECAP TV show will be carried by at least 34 stations during the week of Jan. 27.

A charter is being sought in Delaware by the Idaho Public Power Co, a non-profit organization, which would take over Idaho properties of Washington Water Power if the main Washington system is sold to three PUD's. Listed as members of the board are C. Fred Ashley, Spokane real estate operator; John George, Lewiston, Idaho, director of the National Rural Electric Cooperative Association and also of the Clearwater County Light & Power Co; and Frank H. Arnzen, Grangeville, Idaho, president of Idaho County Light & Power Co, another REA cooperative. The Corporation Trust Co of Wilmington has been named agent for the new company.

George Gadsby's Utah P&L quarterly report contains the following: The Niagara New York Redevelopment Project will be clean cut test as to whether socialistic pressure from Washington will prevail over our private enterprise system. There are no side issues involved. If you would like information concerning this vitally important legislation, I will be glad to have it sent to you upon request." Similar support is coming from Pennsylvania P&L Ohio Edison, Interstate Power, and others.

President Truman, in his State-of-the-Union message, noted we are in the middle of a three-year program to increase electric power supply by 40%, and said expansion of this sort "will mean more jobs and higher standards of living for all of us in the year ahead." He indicated he would not let up on federal generation and transmission building programs.

Trend toward larger and more efficient iron- and steel-making furnaces is one of the outstanding aspects of the great expansion in the U. S. during the postwar period, American Iron & Steel Institute says. Average increase in capacity of iron and steel electric furnaces since 1945 was 40%, to annual capacity of 29,573 tons per furnace.

National Production Authority names Henry H. Fowler, formerly deputy administrator, to succeed Manly Fleischmann, who will devote his full time to DPA.

American G&E System authorizes 200,000-kw unit to be installed by Indiana & Michigan Electric in its Tanners Creek Plant. Unit, to be known as Number 3, will bring system's construction program for 1952-54 to 1.3 million kw.

AIEE's Pittsburgh Section has endorsed A. C. Monteith, vice president of Westinghouse Electric Corp. as candidate for the AIEE presidency for 1952-1953.

Financing—Dayton P&L will sell $15-million first mortgage bonds 1982 competitively around Jan. 29 and will offer its stockholders 256,007 common shares on 1-for-9 basis, record Jan. 28 to expire Feb. 15.

1950 Census preliminary figures, REA says, indicate that on June 30, 1951, 84.2% of U. S. farms had central station electricity.

Washington PUD's will not be deterred in their plan to buy remaining properties of Puget Sound Power & Light by refusal of Western Investment Banking Credit Restraint Committee to approve a $115-million bond issue, according to Harvey Benson, Chairman of the group's executive committee.

Congratulations—Commonwealth Edison elects Raymond D. Maxson, engineering vice president of Public Service Co of Northern Illinois, vice president . . . Northern States Power elects Walter E. Olson, E. K. Thorgaard and J. F. Owens vice presidents . . . B. F. Goodrich Chemical elects John R. Hoover president, succeeding William S. Richardson whose increased responsibilities as vice president of the parent company will include the chemical firm . . . Connecticut L&P elects Paul R. Fleming, formerly secretary, treasurer and vice president . . . Edwin L. Wiegand Co, Pittsburgh, elects Joseph McOrlly and John W. Bailey vice presidents . . . Louis G. Gitzendanner, section engineer, general engineering laboratory, General Electric Co, Schenectady, N. Y., wins Eta Kappa Nu outstanding Young Electrical Engineer's award for 1951.

WASHINGTON COMMENT

JESSE MOCK

The Federal Power Commission is finding that it is just as difficult to reconcile its differences with the Interior Department as it is to remain an uncompromising opponent.

There can be little doubt that Interior is dead set on getting a finger in FPC's licensing pie. Several times in recent years Interior has tried to keep the commission from issuing licenses to private companies for hydroelectric projects.

In the Roanoke Rapids case, FPC took a firm stand against Interior. When the case reached a court of appeals, FPC won with little trouble. So decisive was the court finding that Justice Department lawyers have studied it for months in an effort to determine whether there is the slightest chance it could be reversed by the Supreme Court.

FPC Gets Friendly . . . Now in two other matters, the FPC has apparently tried to accommodate the wishes of Interior—or at least take a step in that direction. There is a strong possibility that Interior will pounce on these two attempts at reconciliation and use them for its own ends.

In the first of these FPC wrote conditions in a license to Idaho Power Co directing it to make any excess capacity on a portion of its transmission system available for government use. This was done at the express request of Interior. A lower court threw out the conditions. Now FPC is appealing to the Supreme Court. Interior is thus in the pleasant position of watching FPC fight Interior's battle.

Interior had first tried to get the company to accept these conditions by writing them in a permit giving the company permission to cross government lands which are under Interior jurisdiction. When a court decided against this method, it was assumed that FPC had jurisdiction to license the construction of lines across the Interior lands.

Interior's Ace in the Hole . . . Just in case FPC loses the fight before the high court, Interior thinks it still has an ace in the hole. This is a letter from the commission to the Secretary of Interior, which reads in part:

"You are correct in understanding that the commission, unless precluded by the courts, intends to require the company to accept the terms of the license. Although if the commission is found to be without jurisdiction, the lands will be returned to the (Interior) department."

FPC would likely argue that there has never been any question about its jurisdiction in the case, and thus it could not possibly disclaim authority over the line or return the lands to Interior. But Interior might argue that the letter means it will get possession of the lands if the conditions are disallowed by the courts. It could be an embarrassing situation for FPC all because it tried to accommodate Interior.

In the second matter, the supplemental opinion recently issued in the Kings River case, FPC has also apparently tried to meet Interior part way. This was done by reducing the term of the license to Pacific Gas & Electric Co from 50 to 30 years. Only explanation given was that the new termination date would more nearly coincide with the termination dates of other licensed projects in the basin. In effect, the reduced term of the licenses moves up the date on which federal government could take over the Kings River project.

Although some of the issues are different, the Kings River dispute is generally similar to the Roanoke Rapids case. It is not hard to imagine that Interior will also take this one to the courts. And after changing the term of the license from 50 to 30 years FPC might have to explain why the term might not be further reduced—say to ten or zero years.

These gestures of reconciliation could be merely tests. In any event, there is not much to do but sit back and see how Interior reacts to them.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Normal line to ground voltages (133 kv) of a 230-kv circuit will flash over about 13 inches in dry air, but hardly do so over three suspension units in rain.

High impedance to flow of the third harmonic currents of transformer excitation may give rise to fifth and higher harmonics.

Aluminum cables in European practice are usually joined with sweated sleeves.

Electrolytic condensers have tendency to become leaky with age.

Steel mills in general are so conscious of safety that it is not uncommon to devote 8 hours of preparation for a maintenance job primarily to assure safety in the operation.

Control for 440 volt industrial circuits is tending toward 110 or 220 volts.

Soil resistivity (thermal) appears to be 50% higher under pavement than the 90 figure commonly used in calculations for pipe-type cable installations.

Power arcs under fast relaying rerely break more than one or two porcelain insulator units. Lightning alone practically never causes breakage.

Hot-line maintenance should perhaps not be attempted if as many as half the insulators below metal parts of the tools are broken.

Preheating of air has beneficial effect on operation of spreader stokers at low loads because it raises the temperature of the fuel bed and thereby lowers the carbon content of the flyash.

Meter laboratory technician after training proved to be superior power plant operator.

Metal-clad switchgear in 25 substations of one utility showed up in fifteen different designs from four manufacturers. The implication is that there should be more standardization.

Statistical Page Unifies Data for EW Readers

Statistics of the electric utility industry, once scattered throughout the pages of Electrical World hereafter will be conveniently collected on this page.

Here you will find a complete up-to-date picture of the industry. A month-to-month index of its activity; a year-to-year comparison of its size and magnitude of operation. In presenting this page we have attempted to provide readers with a complete and convenient source of statistics on industry-wide operation.

Here you will find statistical information on the U. S. business scene, emphasizing the close relationship between the electric utilities and American industry. Industrial production, construction costs, cost of living, and electrical appliance and equipment sales, all play an important role in electric utility planning and operation. All are presented on this page.

In creating this page the editors asked industry statisticians the questions, "What information do you feel will be of the most value to our reader? What information are you most often requested to supply?" This page gives you their answer.

Pacific Coast Division split . . . by Edison Electric Institute in reporting per cent changes in weekly electric power output. Reasons for the change—NW & SW form two separate power pools with no interconnection; there is no similarity in types of industry.

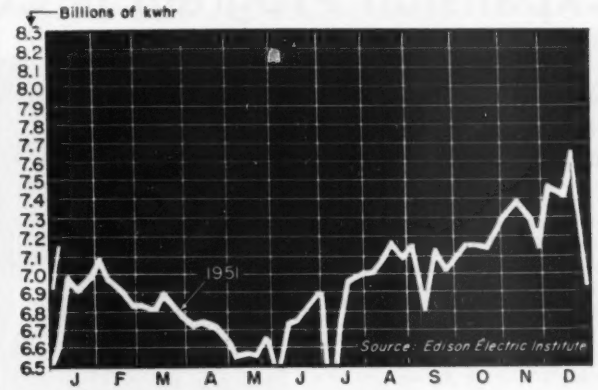
For each issue the editors go to 11 sources of statistics—consult 16 bulletins and publications.

Each month three carefully prepared estimates of industry activity bring our readers an accurate and proven reliable indication of what is happening in the industry—establishing trends before final compilation of data is possible.

Output, for the week, averages for residential service, and peak load estimates for Class I Utilities are obtained from Edison Electric Institute.

Federal Power Commission reports provide capacity, production, sales of energy, fuel consumption, net income statements of Class A & B Utilities and December 1952 peak estimates.

Federal Reserve Board Industrial Production and Electric World Five Industry Production Index estimates are prepared by the McGraw-Hill Department of Economics.



Output Week Ended Jan. 5—7,148,620,000 Kwhr

Per Cent Change From Previous Year

	Total US	New Eng.	Mid Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Jan. 5	+ 8.3	+2.6	+6.1	+4.5	+ 7.6	+ 9.7	+19.7	+10.8	+12.5	+12.8
Dec. 29	+ 6.8	+1.0	+4.3	+3.5	+ 8.7	+ 7.6	+20.2	+11.8	...	...
Dec. 22	+11.2	+8.1	+9.3	+8.6	+11.7	+14.3	+20.1	+13.3	...	...

Electric Power Statistics

		Latest Month	Preceding Month	Year Ago
Peak Load—Class I Utilities (Million Kw)	Oct.	63.33*	62.09	57.28
Capacity (Million Kw)	Oct.	74.68	74.29	67.51
Production (Billion Kwhr)	Oct.	32.44	30.28	29.16
Hydro		7.55	7.04	7.39
Fuel		24.89	23.24	21.77
Sales (Billion Kwhr)	Sept.	27.54	27.45	24.75
Residential		6.82	6.50	5.84
Commercial		4.89	4.91	4.29
Industrial		13.62	13.83	12.66
Other		2.22	2.21	1.97
Fuel Consumption				
Coal (Million Tons)	Oct.	9.58	8.60	8.52
Oil (Million Barrels)		5.44	5.07	6.14
Gas (Billion Cu Ft)		72.00	77.31	61.40
Net Income Class A & B Utilities ($ Million)	Sept.	57.48	53.92	56.88
Dec. 52 Peak, Class I Utilities (Million Kw)*	Oct.	77.4	77.2	69.6
Kwhr per Residential Customer (12 Month Average)	Oct.	1,972	1,961	1,801
Revenue per Kwhr Residential Service (12 Month Average)	Oct.	2.83	2.83	2.90
Canadian Production (Billion Kwhr)	Oct.	4.92	4.40	4.39

Business Statistics

FRB Industrial Production Index †††	Dec.	216*	219*	216
Gross National Product ($ Billion)	3rd Qt	81.7	79.1	72.4
EW 5 Industry Production Index	Dec.	124.0*	123.4*	120.3
ENR Construction Cost Index††	Dec.	114.8	114.7	110.8
BLS Consumer's Price Index	Nov.	188.6	187.4	176.4
NEMA Insulation Materials Sales Index †	Sept.	521	539	514
NEMA Electric Appliances Sales Index (Unadjusted)†	Sept.	264	209	430
NEMA Household Refrig. Sales Index	Sept.	115	98	302

* Estimated † 1936 = 100 †† 1949 = 100 ††† 1937–39 = 100 (Unadjusted)

Expansion Program Is Conservative . . .

. . . Morehouse Committee believes. Survey group tells DPA nation will need more than 30 million kw additional by '55

From the vicinity of Defense Production Administration last week came a new tune: the electric power industry's three-year, 30 million-kw expansion program is, if anything, too conservative.

All last year, when the industry tried desperately to wangle controlled materials from the agency, observers got the distinct impression DPA believed the industry was trying to expand too fast.

The tune changed with submission of a report by the Morehouse Committee (EW, Oct. 15, 1951, p. 14). Officially, DPA is not committed to orient its materials distribution in line with the conclusions of the report. But DPA Administrator Manly Fleischmann, who appointed the committee, is honor-bound to consider the report carefully. The question still remained: How much expansion in any single field is humanly possible with the materials available?

EDWARD W. MOREHOUSE, vice president of General Public Utilities Corp, heads the committee that last week handed DPA a report on its survey of the nation's power requirements

CMP Problem . . . If Fleischmann was looking for justification for doling out a larger share of controlled materials for the power industry, the report supplied it. But if he hoped to find ways of cutting back the utilities program to save precious materials, he was in for a disappointment.

Late last week he had not made up his mind on the report. Word was that he might now attempt to set up a program of a certain size to be followed during the next three years.

Defense Electric Power Administration, claimant agency for the utilities, could take some solace from the Morehouse Committee findings. Depa's statistics fared pretty well under the committee's probing, and direct criticism of the agency was all but nil.

Rocky Road . . . But if the committee's recommendations are carried out, Depa will face a rocky road. One of the major recommendations is that each major plant addition be classified with respect to its usefulness to defense production and regional power supply, and that materials be allotted accordingly. This ticklish job would certainly fall in Depa's lap.

To begin with, the Morehouse group tossed out the off-cited figure of 27 million kw for expansion in the next three years because it was outdated. It based its review on a 1952-through-1954 program of 30 million kw, which appeared to be the industry's and Depa's figures as gleaned from manufacturer's order boards.

Also it took a look at December peak load estimates and capacity figures prepared by Depa and the utilities. At 22 meetings with utility operating personnel, the figures were discussed at length.

From this probing, verifying, and squeezing, the committee concluded:

1. 1952 figures (see table) are fairly realistic.

2. 1953 peak estimates may be too low by two million kw.

3. 1954 peak estimates may be low by as much as five million kw.

Underestimated? . . . The committee believes the utilities and Depa may be underestimating potential load for residential and rural customers to some degree. Main reason for the discrepancy, says the committee, is the potential defense loads and industrial loads, which the utilities could not be expected to know for either security or practical reasons. Even the committee, which had access to many classified plans, admits that some of the potential load is not firm enough for utility planning purposes.

Among the big loads which can be expected are more atomic energy production plants, additional aluminum and titanium plants. In turn, these will call for other industrial expansion and more electric power load.

On the capability side of the ledger, the committee wonders how much slippage is occurring on units now on order. It doubts that anybody can

possibly know the exact figures, but hazards the prediction that some of the units can't possibly be kept on schedule even with larger material allotments.

The Reserves . . . For its purposes, the committee set up a 8.5 to 11% margin between capability and peak load as the rock bottom margin to stave off curtailment. It also noted that defense production loads appear to be concentrating between the Great Lakes and the Gulf of Mexico.

On this basis, the committee foresees a general power deficiency during the present year. All regions will be affected to some extent.

For 1953, with present in-service schedules maintained, the committee foresees some surplus in federal power commission Regions I, VI and VIII. Region VII will have a serious deficiency. Region II, much of IV and most of III and V will show a deficit.

For 1954, regions I, VI and VII should have a larger surplus. Regions II, III, IV and V would show an overall deficit and region VII, with proper hydro conditions, should have a surplus.

No Accusations . . . The committee does not accuse the utilities of trying to build unduly large reserves. The present schedules, it says, are not out of line with needed reserves in normal times. But these are not normal times, comments the committee. If present in-service schedules are allowed to stay fixed, there will be an accumulation of surpluses in some areas and deficiencies in other in both capacity and capacity-timing.

The committee sees no possibility of balancing power supply and demand for the present year and for the first three quarters of 1953 because equipment and construction schedules are so meshed that changes would only result in losing overall capacity.

But for the last three months of 1953 and all of 1954, the group believes manufacturing and construction schedules can be rearranged to stave off power deficiencies. This would presumably be done by Depa and National Production Authority through their control over material allotments.

Is It Necessary? . . . Each proposed project would be classified as to its essentiality to defense loads and area power supply. Those most needed would be given the go-ahead, and materials allotted. It is admitted that close examination of supply and loads as well as manufacturing schedules will have to be carried on if such a program is to work.

But the alternative, says the committee, is curtailment of power to vital defense production, voluntary residential curtailment and the other things that happen when there is not enough electric power to go around.

Without going into the question of materials available to carry out this program, the committee comments:

One for 100 . . . Every kilowatt of new capacity requires critical material—steel, copper and aluminum. "Our investigation shows that one kilowatt of capacity can be fabricated and constructed with 1/100 as much of these materials as the same kilowatt can supply the power to produce in one year." Put another way, every kilowatt is worth 100 times its weight in critical materials each year.

The four-man committee recognizes that the electric power industry is a constantly changing and expanding thing, and does not expect its report to remain unchanged for years to come. It recommends that a group be set up to bring the report up to date from time to time as new facts appear.

What the Morehouse Committee Report Said:

1. The electrical utilities' 1952-through-1954 expansion program of 30 million kw is not excessive and might possibly be too low. Within limits of present outlook, power loads will continue to rise sharply in '52 and '53 with a more gradual rise in '54. Required lead times make it impossible to change program in 1952, and will permit only minor changes in '53. A few months are still left in which additional 1954 generating equipment can be ordered.

2. If entire nation could be considered as a power-supply entity and in-service schedules maintained, a fairly well balanced power supply and demand could be established by latter 1954. But under existing schedules, and because the generating facilities will not be strategically placed, some regions and areas will be hard hit as others acquire a comfortable margin of electric power.

3. Because defense loads are concentrating in regions between the Great Lakes and the Gulf of Mexico, the power supply in this area will become tighter. The Northeast and the extreme West, except the Pacific Northwest, will achieve increasing reserve margins during the next three-year period. This will intensify the imbalance between regions if today's schedules stand.

4. Unless today's schedules are altered against this imbalance, curtailments affecting defense industries will become unavoidable.

5. Inter- and intra-regional interconnections would afford some possible relief from the situation and steps are being taken in this direction. Theoretically, it is possible to spot defense loads in such a way as to afford a measure of relief.

6. Best way to correct the impending imbalance is to develop a realistic program setting up a project priority, and keep a close eye on slippages and other factors which would upset the realistic schedule.

7. Little can be done about 1952 generating equipment other than to insure that strategic machines do not fall behind schedule at the expense of less strategic machines.

8. There is not much than can be done with in-service schedules for the period January through September of 1953 except to speed more essential machines at the expense of less essential. But for machines coming on the line after October of next year, it would be possible to take a completely fresh look at all units on order with a view to rearranging schedules to fit regional power needs.

9. These recommendations should lead to a reasonably well-balanced power supply with the flexibility to meet new defense and industrial loads. Power curtailments could be avoided in 1954, and curtailments for 1952 and '53 could be minimized.

Report's Estimate of Supply and Demand:

Year	Capacity Additions	Total Capability	December Peak Loads
		(Millions of kw)	
1952	9.5	84.46	77.84
1953	12.2	96.68	85.22
1954	8.4	105.08	90.80

In estimating total capability, it is assumed capacity is 75 million kw at beginning of 1952.

Buchanan Named to Head FPC

Truman, seeking man with experience, chooses former vice chairman and commission member since 1948

Seeking a person with experience in commission procedure, President Truman has appointed Thomas C. Buchanan to head the Federal Power Commission. Buchanan has been a member of FPC since July 1948, and served as vice chairman from May 1950 until his appointment as chairman.

A lone dissenter in a number of gas pipeline cases, Buchanan has usually sided with the majority on most cases involving the licensing of hydroelectric and transmission facilities. His best-known dissent was filed in the Phillips Petroleum case last summer, when the commission decided by a 4-1 vote it had no control over natural gas at the wellhead.

Favored Federal Projects . . . In his capacity as acting chairman of the commission, Buchanan appeared before two Congressional committees last fall to favor federal construction of a huge new hydroelectric development on Niagara River near the Falls. He also appeared before the House Public Works Committee in connection with a bill providing for federal construction of thermal plants in the Pacific Northwest, but did not give outright endorsement of the measure.

In appointing Buchanan to the chairmanship, President Truman was acting partially on the advice of former Chairman Mon C. Wallgren, whom Buchanan succeeds. Before leaving the position, Wallgren had recommended that the post be filled by someone already intimately acquainted with the commission's work. This made the Pennsylvanian a likely candidate (EW, July 2, 1951, p 56).

Served in Pennsylvania . . . The new chairman is a member of the Pennsylvania and American Bar Associations. He served on the Pennsylvania Public Utility Commission from 1937 to 1945 and on the predecessor Public Service Commission in 1936 and 1937. Following his retirement as a member of the state commission, he practiced law in Beaver County, Pa.

A veteran of World War I, Buchanan was a lieutenant in the field artillery. He received a bachelor of arts degree from Washington and Jefferson College and was admitted to the Pennsylvania bar in 1922.

NEW FPC CHAIRMAN is Thomas C. Buchanan, a member of the commission since July 1948. He succeeds Mon C. Wallgren

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Missouri Basin Study Planned By President

In setting up an advisory commission to study development of the Missouri River Basin, President Truman recently gave indirect encouragement toward the establishment of a Missouri Valley Authority.

The executive order establishing the 11-man commission made no specific reference to basin organization, but the President in a separate statement spoke of "need to improve our present organizational arrangements." He said he hoped the commission would give him advice in that field.

The order gave the survey group sweeping authority to conduct studies and recommend changes in the resources program for the basin. The study's scope covers much the same ground explored last year by his Water Resources Policy Commission. Basic legislation to establish federal water policy in line with the advice of that commission will be ready for the President in about a month. He is expected to submit it to Congress shortly afterward.

Wide Scope . . . The Missouri Basin commission is authorized to study all parts of the watershed and other portions of the basin states. With respect to basin power, the order allows it to extend its studies and recommendations outside the area. The group is to report by Jan. 1, 1953.

Truman made it clear that construction of Pick-Sloan Plan projects is to continue as rapidly as the defense emergency permits. His budget message, he said, will ask funds for work that must go on, including the start of a limited number of new projects.

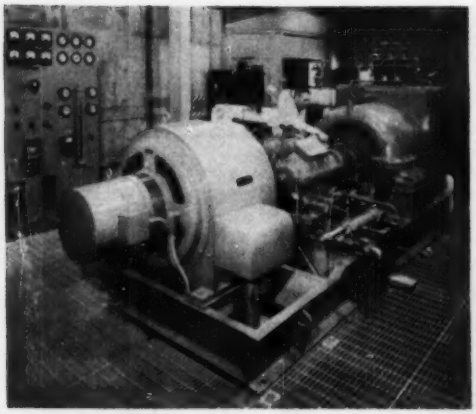
His statement recognized the Pick-Sloan Plan and the later land resources plan of the Agriculture Department as containing "much that is sound and valuable today." But he said there is need now for thorough re-evaluation of the whole problem.

After the Floods . . . The commission set-up follows the intent of Senate and House resolutions introduced after last summer's Kansas-Missouri floods. Congress failed to act on these resolutions although the conferees of the civil functions appropriation bill urged consideration. In the Senate, instead, the staff of the Public Works Committee was instructed to make a Missouri Basin study. This staff is preparing a report.

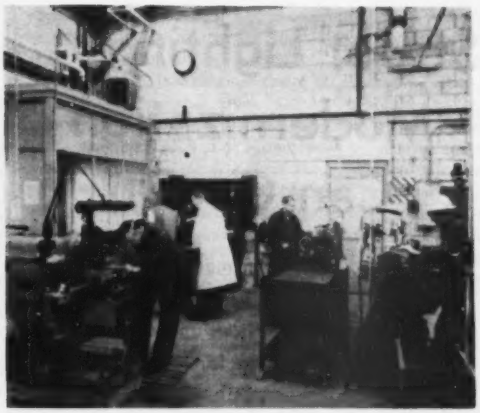
Truman's appointees, however, won't have to be confirmed by Congress.

The President instructed the commission in carrying out its assignment to:

1. Review and evaluate existing and proposed plans and programs;
2. Conduct on-site surveys and appraisals and hold public hearings;
3. Ascertain estimated costs and benefits, to the extent practicable;
4. Consult with state authorities and other groups;
5. Study the present and prospective economy of the basin and the economic soundness of plans and programs;
6. Consider the proper division of financial responsibility between the federal government and the states; and
7. Give necessary emphasis to flood control, in view of the recent flood.



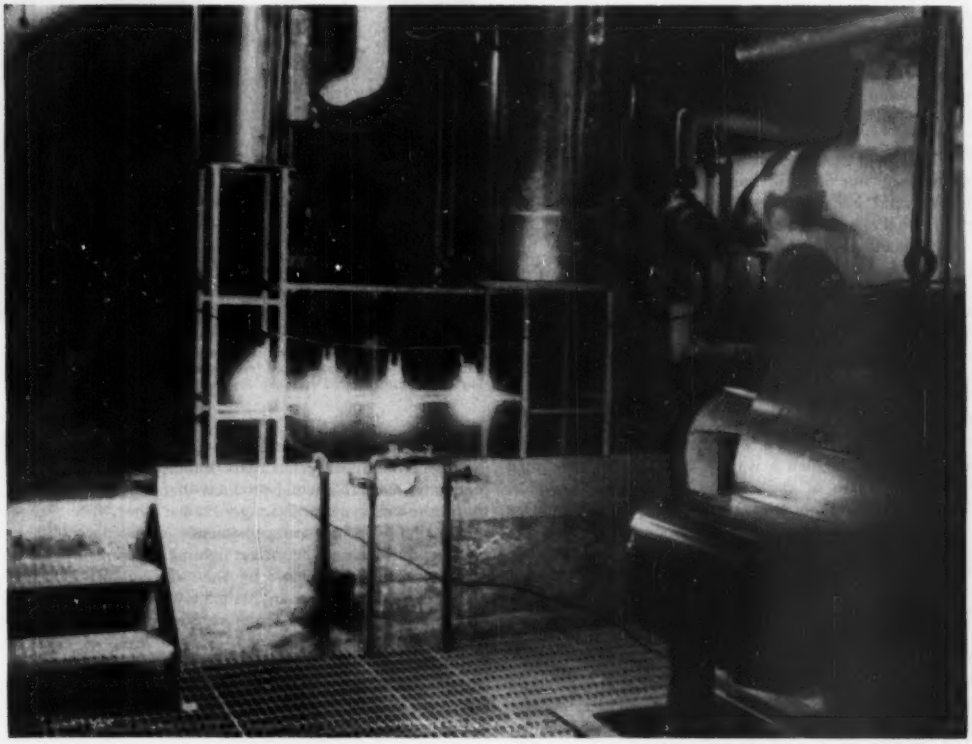
CONVENTIONAL turbo-generator, above, operating on heat from experimental breeder, produced electricity from the atom Dec. 20



DR WALTER H. ZINN (white jacket), who engineered the experiment for AEC, is shown in shop operating on atomically produced power

Useful Power from Atomic Energy . . .

. . . is produced for first time at AEC's National Reactor Testing Station in Arco, Idaho



ELECTRIC BULBS drew first power from atom, supplied by generator at right. The 100-kw reactor power plant later handled all needs of building in which it is housed. Argonne National Laboratory, which operates station, plans to continue experiments in power generation

Street Lighting Modernization Can Go On . . .

. . . But equipment must be put where it will do the most good. Accident, crime prevention, and cable saving are guiding factors. Ambitious programs must be postponed or delayed.

HUGH ESTES, Chief
Exterior Lighting Unit, Electrical Equipment Division
National Production Authority, Washington, D. C.

Concern has been expressed recently over what the status of street-lighting modernization programs will be during the period when mobilization will be consuming increasing amounts of metals and other materials.

Some extreme opinions have been voiced on the subject. One group of extremists adopts the defeatist view that all street-light modernization might as well be dropped for the duration of the emergency. A group at the other extreme maintains that active promotion of new street lighting is almost a panacea for all our economic problems.

It may help clear the air, however, if we present a sober analysis of our defense mobilization aims and discuss factually the impact on the street-lighting industry of the controls necessary to effect these aims.

The mobilization effort was set in motion because of a strong national conviction that our country was in grave danger and that there was the most urgent and immediate need to build up the military and economic strength of the United States as a deterrent to Communist aggression. This strength will have to be maintained at a high level throughout the foreseeable future.

Military Program . . . The direct military program—guns, tanks, planes, ammunition, and the like—has been scheduled, however, in such a way as not to take more than its realistic share of the amount of material available. And early in the program, it was decided that it would be utter folly to close down civilian producers because the items they produce are, in the long run, essential to American industrial operation. Shutting down great civilian industries would result in tremendous dislocations to labor and the economy as a whole.

As a result of all these considerations, a tremendous program of expanding our productive capacity is under way. After this program has been completed, we should be able to maintain a strong military establishment, and at the same time, through increased production of civilian goods, maintain and improve the high American standard of living.

General Electric Company

MODERNIZATION PROGRAMS of street lighting which require little cable are within the "authorized level." Resourcefulness and engineering ability are required to make the most effective use of materials

Middle Ground . . . Street lighting obviously comes in the middle ground between strictly military supplies on the one hand and ornamental products that can be eliminated during severe material shortages on the other. The recognition of this by government officials is evidenced by the production levels set for street-lighting equipment.

Material made available for the street-lighting industry permits production at approximately 85% of the rate maintained during the 12-month period immediately preceding the invasion of Korea. Such a level, of course, is insufficient by far to permit installation in one year of all equipment necessary to bring America's street lighting up to the standards set by the American Standards Association. These standards are estimated conservatively to require five times the existing connected street-lighting load. But even if there were no struggle in Korea, street

lighting would not be brought up to ASA standards in less than three years.

Authorized Production . . . The authorized level, however, is, I am convinced, all the country can afford at the present in view of the scarcity of some critical materials. This level should be sufficient to carry on a substantial program of modernization and at the same time keep existing lighting in a good state of repair. However, there will be demands on the resourcefulness and engineering ability of all concerned with street lighting to make sure the authorized production is used most effectively.

The most critical material used by the electrical industry today is copper. There seems to be no relief in sight for some time to come on the supply of copper. I think we must plan on several years in which all street-lighting modernization projects will have to be evaluated as to their consumption of cable. Copper for cable is a "controlled material."

Saving Copper . . . When either a utility or a municipality undertakes any project using more than a specified amount of cable, specific authority in the form of an allotment to purchase that cable must be obtained. For a utility, it comes out of an allotment of copper from the Defense Electric Power Administration. For municipal or state-owned lighting systems, the allotment comes from the Bureau of Public Roads through the state highway department. Utilities and municipalities alike are thus charged with the responsibility of saving copper by making their requests as small as possible.

Much misunderstanding surrounds the area of "B" products. "B" products, loosely defined, are completed manufactured items. Consumption of copper, aluminum, and steel in producing these products is controlled by the National Production Authority under the direction of the Defense Production Administration. "B" products used in the street-lighting industry include luminaires, brackets, transformers, control equipment, steel and aluminum poles, etc. A utility or a municipality cannot conserve controlled materials by not purchasing "B" products. NPA determines how much shall be used in the manufacture of these products, and any user who cuts down his purchase of "B" items denies himself his fair share of this production—a share that will be used by someone else.

Which to Allow . . . It all leads up to an analysis of just which modernization programs can be permitted freely and which must be delayed or prolonged. Replacing antiquated fixtures with modern luminaires on an existing circuit is a perfect example. Little or no additional cable is used. In most cases, lamp sizes can be increased on series circuits using no additional cable. True, transformer sizes may have to be increased, but transformers are "B" products. Their copper content does not come out of the user's allotment. Still another project might involve the use of a small quantity of pole and bracket cable, a small extension of series cable to close in two loops where one existed before, or the use of transformer primary and control cable only. All such programs, and many similar ones, can go forward without delay.

Delay Some Programs . . . On the other hand, here is an example of a modernization program that will have to be postponed. A major city floats a bond issue for the installation of 10,000 street-lighting standards with underground wiring. It wants the entire program completed in 3 months. In normal times, the action would be commendable. Now, however, even assuming the cable were made available, such a program must be delayed. Current allotments of steel permit total production of approximately 10,000 lighting standards per quarter. It would be most unsound to have the entire production of the country going to one city. A more sensible approach would be to extend an ambitious program over a longer period—not postpone it entirely, but spread the work out.

Priority to Critical Areas . . . Reference has been made to resourcefulness and careful engineering in the installation of street lighting under present conditions. Remarkable records of accident prevention and still more startling reductions in night fatalities have been made through improved lighting in danger areas. Certainly it would appear sensible knowing it is impossible to get delivery of enough equipment to relight a town completely to install what lighting is available at places where it will accomplish the most good. Stretches of highway with high night accident records, heavily traveled intersections, underpasses and grade crossings, the crown of a hill or a bad curve are but a few obvious examples. Night crime records should be examined. Priority for new or increased lighting facilities should be given to critical areas and bus-stops. Areas and streets congested as a result of defense housing or defense factories must also be considered.

But one should not overlook long-neglected existing trouble spots in favor of less necessary lighting because the latter comes under the magic and currently popular word "defense." Through analysis of each proposed installation with the above considerations in mind and through preference for projects using little or no additional cable, existing production of street-lighting equipment can be utilized to best advantage.

Continue Programs . . . The greatest concern of the industry should be the municipality or utility much too ready to seize on any situation as an exuse to avoid street-lighting commitments. Often, such an attitude exists where modernization and additional lighting are most needed. Progressive communities and utilities, recognizing the accident prevention value of up-to-date lighting in savings of lives and property will continue their programs within the limits of defense mobilization restrictions.

Keep Selling . . . Street-lighting modernization will continue. The programs which are more ambitious from a copper cable consumption standpoint will have to be postponed or stretched out. How many people will be alive a year from now who might otherwise have been killed in night accidents will depend on the ingenuity of street-lighting engineers throughout the country, and on how well they sell their management and the public on the basic principle of putting available lighting where it is most needed. Although we in the industry know the many benefits of modern street-lighting, it is never brought from under the proverbial bushel basket. Good street-lighting must always be sold. And this is no time to stop selling.

FINANCIAL

YIELDS (%)—Operating Electric Utility Securities

Quality	Bonds			Preferred Stocks			Common Stocks		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
DATE									
1952									
Jan. 3	3.02	3.06	3.22	4.32	4.47	4.89	5.36	6.08	6.70
Dec. 27	3.02	3.07	3.21	4.32	4.50	4.91	5.42	6.18	6.84
END OF QTR.									
4th 1951	3.02	3.07	3.21	4.32	4.50	4.91	5.42	6.18	6.84
3rd 1951	2.87	2.91	3.04	4.05	4.27	4.61	5.52	6.24	7.05
2nd 1951	3.02	3.11	3.23	4.11	3.37	4.68	5.73	6.38	7.78
1st 1950	2.87	2.93	3.00	3.96	4.19	4.52	5.47	6.20	7.13

Data: Reis & Chandler, Inc.

WWP Sale Opponents Present Their Views

Opponents of the proposed Washington Water Power Co common stock sale were scheduled to have met with the Securities and Exchange Commission Jan. 11.

SEC Secretary Orval Dubois said invitations were sent by telegram but added that "this is in no wise an announcement of a formal hearing." The meetings, he declared, were to be held "individually and in private."

American Power & Light Co which holds the WWP stock, consented to grant SEC until the close of business Jan. 14 to make a decision. Regular time limit is 10 days from the filing of a notice of sale, which was filed Dec. 26. (EW, Jan. 7, p 46).

If the sale is, in fact, to public bodies in the Northwest, SEC would have no jurisdiction. But if the commission should decide that the sale is, in part, to private interests, then it could attempt to exert jurisdiction.

Earlier in the week, SEC's Vice Chairman Donald C. Cook said he again would refrain from voting on the jurisdiction issue. Early in 1951, his abstention from voting resulted in a 2-2 decision not to exert jurisdiction over a similar proposed sale. However, some of the details of the presently proposed sale differ from the earlier proposal. Also, Robert I. Millonzi has succeeded Edward T. McCormick. McCormick along with Chairman Harry A. McDonald opposed exerting jurisdiction over the early 1951 proposed sale. McDonald has now been named to head the Reconstruction Finance Corp, and it is believed the vote on jurisdiction will be taken before he leaves SEC.

Sen Herman Welker, Idaho Republican, has added his voice to the growing protests against the proposed sale. Previously, SEC had received some 15 to 20 messages urging it to hold hearings and exert jurisdiction over the sale.

Welker told a reporter, "The people of Idaho will hold the commission strictly accountable for the irreparable injury that will be done if this sale goes through."

The Spokane Department of Public Utilties has asked the Federal Power Commission to oppose the proposed sale, but FPC showed little inclination to move in early last week.

A hearing set for Jan. 8 on the proposed distribution of the WWP stock to AP&L stockholers has been indefinitely postponed in the light of the notice of sale.

FINANCIAL BRIEFS

Program committee of the New York Society of Security Analysts has scheduled the following luncheon meetings: Jan. 23, Tampa Electric Co, and Jan. 30, Potomac Electric Power Co.

Voters at Puyallup, Wash., have rejected a proposal, by a 1213-to-1188 vote, that the city purchase the facilities of the Puget Sound Power & Light Co within the city. The purchase was proposed because Pierce County, in which Puyallup is located, has no PUD and hence Pierce County properties of Puget would be managed by other PUD's in the state.

Brazilian Traction Light & Power Co stockholders will vote on Feb. 5 on proposed increase from 15.2 million to 20 million shares . . . **Central Maine Power Co** plans to borrow $6 million from banks.

Merger of Tide Water Power Co with Carolina Power & Light Co (EW, Dec. 31, p 50) moved a step nearer reality as the companies asked the Federal Power Commission to authorize the transaction.

Electric Utility Financing

Company and Description	Amount of Offering (000)	Offering Price	Yield to Public
WEEK OF JANUARY 3-9			
Bonds			
Seattle, Wash.—municipal l and p rev, 2¼% 1962-1986	$25,000	various	††
Philadelphia Electric—1st and ref mtg, 3¼% 1982, new money	35,000	100.96%	3.20%
WEEK OF JANUARY 10-16			
Common Stock			
Southern Utah Power—15,761 sh (to common holders on 1-for-4 sh basis, record Dec. 27 to expire Jan. 11)	$181	$11.50	8.70%
SCHEDULED FOR JANUARY-FEBRUARY			
Bonds			Bid Date
Indiana & Michigan Electric—1st mtg 1982	$17,000		Jan. 22
Indiana & Michigan Electric—serial notes 1956-1967	6,000		Jan. 23
Central Illinois Public Service—1st mtg 1982	5,000		Jan. 29
Pennsylvania Power—1st mtg 1982	6,000		Feb. 5
Preferred Stock			
Florida Power Corp—51,550 sh $100 par cum conv	5,155		.....
Kansas City Power & Light—100,000 sh $100 par	10,000		*Jan. 22
Central Illinois Public Service—50,000 sh $100 par	5,000		**Jan. 22
Pacific Gas & Electric—163,986 sh $25 par 5% 1st Series A (to be offered about Jan. 15 to employees at 24⅓ of which 23⅓ is to be paid through payroll deductions, to expire Feb. 8; no underwriting)	4,099	$24.50	5.10%
Common Stock			
Pacific Power & Light—552,792 sh (200,000 sh to be sold by company and balance for selling stockholders)	.....		†Jan. 22
Kansas City Power & Light—317,792 sh (to be offered to common holders on 1-for-6 basis, record about Jan. 22 to expire Feb. 6)	.....		*Jan. 22
West Penn Electric—440,000 sh (to be offered to common holders on 1-for-8 basis, record Feb. 1 to expire Feb. 18)	.....		Jan. 30
Southwestern Public Service—(to be offered to common holders on 1-for-13 or 1-for-14 basis, record about Feb. 1)	.....		.....

* Blyth & Co–First Boston Corp group, underwriters.
** To be offered by Blyth & Co–First Boston group, underwriters.
† To be offered by Lehman Bros. group, underwriters.
†† Being reoffered to yield 2.35% to a dollar price of 99½.

Electric Utility Earnings

Company	Period Months	Ended	Net Income 1951	Net Income 1950	Earnings Per Common Share 1951	Earnings Per Common Share 1950
California-Pacific Utilities	12	Nov.	$444,921	$540,817	$1.66a	$2.39a
Central Arizona L&P	12	Nov.	1,328,142	1,878,648	....	....
Consolidated Gas E&P of Baltimore	11	Nov.	8,097,906	9,264,435	1.45b	1.73b
Consumers Power	12	Nov.	19,638,117	17,845,064	2.63c	2.58c
Dallas P&L	12	Nov.	3,358,446	3,137,155	....	....
El Paso Electric	12	Nov.	1,408,070	1,360,633	1.75	1.69
Gulf States Utilities	12	Nov.	5,929,443	6,052,985	1.60e	1.85e
Kansas City P&L	12	Nov.	4,348,421	4,489,716	....	....
Middle South Utilities and Subsidiaries	12	Nov.	10,737,214f	10,546,722f	1.77	1.88
Texas Electric Service	12	Nov.	6,445,881	5,401,692	....	....
Texas P&L	12	Nov.	6,105,296	5,886,426	....	....

a—On average of 215,881 shares in 1951 and average of 176,546 shares in 1950; b—On average shares outstanding; c—On shares outstanding at end of each period; e—On 2,884,590 shares in 1951 and 2,719,899 shares in 1950; f—Consolidated net income—carried to consolidated earned surplus.

REGULATIONS

Electric rates for residential customers in Bryan, Ohio, will be cut an average of 20%, effective Feb. 1, as a result of increased sales and improved efficiency of the municipal light plant, Board of Public Affairs has reported.

WALL STREET

Dow-Jones stock averages for utilities went to 47.90 at the close of business on Jan. 5, 1952, highest closing level since Sept. 17, 1931. New common stock highs were registered by the following companies listed on the New York Stock Exchange: Commonwealth Edison Co, Consolidated Edison Co of New York, General Public Utilities, Interstate Power Co, Public Service Electric & Gas Co, and Southern California Edison Co.

HARRY A. McDONALD, a Republican who is now chairman of Securities and Exchange Commission, will succeed W. Stuart Symington as head of Reconstruction Finance Corp.

MEETINGS

McManus to Address EEI-SEE Conference

The Industrial Relations Conference, sponsored jointly by Edison Electric Institute's Industrial Relations Committee and Southeastern Electric Exchange's Personnel Administration Section and Southwestern Personnel Group, will be held Jan. 17-18 at Roosevelt Hotel, New Orleans, La.

A highlight of the conference will be an address to be delivered by C. B. McManus, president of SEE and The Southern Co.

The program for the conference will also include discussions of recruiting and maintaining middle management manpower, an appraisal of the University of Michigan utility management program, employee information programs, a college faculty seminar, wage and salary stabilization, union-management cooperation, and the employees part in the public power fight.

Individual meetings will be held by EEI's Industrial Relations Committee and SEE's Personnel Administration Section and Southwestern Personnel Group.

CALENDAR

★American Institute of Electrical Engineers
Winter General Meeting, Hotel Statler, New York, January 21-25; Welding Conference, Rackham Memorial Bldg., Detroit, Mich., April 16-18, arranged jointly by American Welding Society, Detroit Section, and Industrial Electrical Engineers Society, Detroit.

National Adequate Wiring Bureau
Annual Conference, Sherman Hotel, Chicago, January 24-25.

National Association of Purchasing Agents
Public Utility Buyers' Conference, Cleveland Hotel, Cleveland, Ohio, February 4-5.

Instrument Society of America
1952 Regional Power Plant Instrumentation Conference, New York Section, Hotel Statler, New York, February 7-8.

Missouri Valley Electric Association
Industrial-Commercial Sales Conference, Hotel President, Kansas City, Mo., February 7-8; Engineering Conference, Hotel President, Kansas City, Mo., April 2-4.

Pennsylvania Electric Association
Winter Meeting, Transmission-Distribution Committee, Penn Harris Hotel, Harrisburg, Pa., February 7-8; Hydraulic Power Committee, William Penn Hotel, Pittsburgh, Pa., February 7-8; Systems Operation Committee, Benjamin Franklin Hotel, Philadelphia, February 14-15; Winter Meeting, Relay Committee, Fort Stanwix Hotel, Johnstown, Pa., February 20-21; Prime Movers-Electrical Equipment Committees, Benjamin Franklin Hotel, Philadelphia, February 28-29.

Edison Electric Institute
Electrical Equipment Committee, Netherlands Plaza Hotel, Cincinnati, Ohio, February 11-12; Transmission-Distribution Committee, New Hotel Jefferson, St. Louis, February 14-15; 18th Annual Sales Conference, Edgewater Beach Hotel, Chicago, March 31-April 3; Purchasing-Stores Committee, Roosevelt Hotel, New Orleans, La.

Public Information Program
East North Central Region Meeting, Fort Wayne Hotel, Columbus, Ohio, February 21.

★American Society for Testing Materials
Spring Meeting-Committee Week, Hotel Statler, Cleveland, Ohio, March 3-7; Annual Meeting, Hotels Statler-New Yorker, New York, June 23-27.

National Electrical Manufacturers Association
Section Meeting, Edgewater Beach Hotel, Chicago, March 10-13; 4th International Lighting Exposition - Conference, Industrial-Commercial Lighting Equipment Section, Cleveland Auditorium, Cleveland, May 6-9.

National Association of Corrosion Engineers
Annual Conference, Buccaneer Hotel, Galveston, Tex., March 10-14.

Southeastern Electric Exchange
Engineering-Operation Section Conference, Jung Hotel, New Orleans, La., March 13-14; Annual Conference, Boca Raton Hotel, Boca Raton, Fla., April 21-23.

★Illuminating Engineering Society
South Pacific Coast Regional Conference, Hotel Sir Francis Drake, San Francisco, March 13-14; Southwestern Regional Conference, Hotel Tulsa, Tulsa, Okla., April 6-8; Southern Regional Conference, Hermitage Hotel, Nashville, Tenn., April 20-22; Canadian National Conference, Hotel General Brock, Niagara Falls, Ontario, Can., April 30-May 2; Great Lakes Regional Conference, Hotel Statler, Cleveland, Ohio, May 5-6; East Central Regional Conference, Webster Hall Hotel, Pittsburgh, Pa., May 22-23; Northeastern Regional Conference, Hotel Preston, Swampscott, Mass., June 19-20.

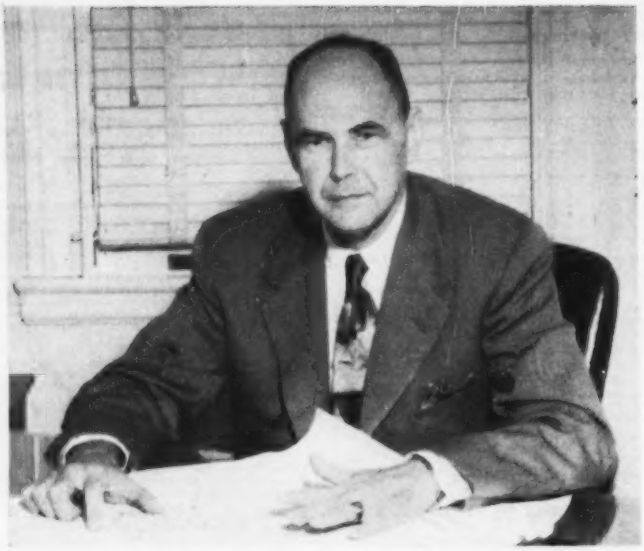
Pacific Coast Electrical Association
Operating Economics Section Conference, Hotel California, Fresno, Calif., March 20-21; Administrative Services Section Conference, Los Angeles, April 17-18; Business Development Section Conference, Hotel Huntington, Pasadena, Calif., April 24-25.

American Society of Mechanical Engineers
Spring Meeting, University of Washington, Seattle, March 24-26.

★ Addition this week.

Index Is Available

Electrical World's semi-annual index has been prepared and copies are now available upon request. It may be obtained without charge. Address requests to Electrical World, Editorial Office, 330 W. 42nd Street, New York 18, N. Y.



Clapp Heads Florida Power

"Our two major jobs for the immediate future are to improve earnings and complete our construction program"

That's how William J. Clapp sized up the situation Jan. 1 when he assumed the presidency of Florida Power Corp. As executive vice president since last June he is familiar with both jobs. He worked closely with Pres W. C. Gilman, who has returned to New York as head of W. C. Gilman & Co, a consulting engineering firm.

The company plans to add four units with a total capacity of 197,000 kw by the end of 1954. This will give the system a capability of 439,300 kw. It was 121,000 kw five years ago.

Must Expand . . . Clapp is well aware of the importance of this construction program. "Today Florida is one of the two fastest growing states in the nation. (Florida Power Corp is growing with it and now has 170,320 customers in the state and in southern Georgia.) If our company is to keep up with this growth, we must continue to expand. Improved earnings depend on the completion of the expansion program, and completion of the program depends on improved earnings. I am confident that we will lick both of these problems."

The new president has come up from the ranks. He joined the old Florida Public Service Co at Orlando in 1925 as a commercial manager. In turn he was division engineer at DeLand, division manager at Eustis and Lake Wales, and by 1934 general superintendent of the system.

With Eisenhower . . . As Captain Clapp he reported for duty in 1943 with the Corps of Engineers. In Europe he served in the advance section of the communications and engineering headquarters. After VE Day he was transferred as a major to the utility section of General Eisenhower's staff commanded by Col Walker L. Cisler, now Detroit Edison president.

Upon returning to civil life, Clapp found himself system production engineer for the entire FPC system, formed in 1944 by the merger of Florida Public Service, Florida Power, and Georgia Power & Light Co. He was advanced to production superintendent in 1947, to vice president in charge of operating departments in 1950, and to executive vice president in June 1951.

More Copper . . .

. . . Is on the way to make the outlook brighter, according to chairman of Anaconda

The copper situation is not so gloomy as mobilization officials have painted it, Cornelius F. Kelley, chairmon of the board of Anaconda Copper Mining Co, said last week.

Admitting the metal is in critically short supply today, he asserted the situation will begin to improve materially in the latter half of this year.

Kelley charged that during the past year "responsible mobilization officials have conducted a systematic campaign that practically amounted to propaganda urging the substitution of aluminum for copper." The Anaconda official pointed out that substitution of one metal for another is difficult and in many cases can't be done.

Anaconda's Estimate . . . Here is the copper situation as seen by Kelley:

Current U. S. copper mine production, including secondary treated by primary refineries, averages about 90,000 tons a month. An additional 35,000 tons is available from foreign sources, bringing present monthly supply to about 125,000 tons.

The first major increase in production will come when Anaconda's Greater Butte Project and its new sulphide plant at Chuquicamata, Chile, begin operations this spring. The additional production obtained from these projects above present levels should total 95,000 tons in 1953. By the end of 1953 the company's new Yerington project is expected to add another 30,000 tons yearly.

More Coming . . . Other projects now underway in the U. S. and in friendly foreign countries should yield additional copper at an annual rate of about 80,000 tons by 1954, bringing the total boost in copper production to about 205,000 tons a year.

Projects already under construction or planned in the U. S. and abroad should further augment world supply by an additional 240,000 tons beginning in 1955-56.

By 1956 it is estimated that the monthly supply of copper available in the United States (including imports) could reach 150,000 tons.

"LET'S DECIDE TO LIKE ALUMINUM..."

. . . That's what these authors said five years ago. Then they found the economics didn't justify their preference for copper, so they switched to aluminum. Meanwhile they have had some troubles, found some solutions, see the need for more; all of which are described here by . . .

C. E. BATHE, Superintendent of Transmission and Distribution

BRYCE BRADY, Superintendent of Engineering
Oklahoma Gas and Electric Company, Oklahoma City

Experience of the Oklahoma Gas & Electric Company with aluminum as a conductor material for urban distribution systems, leads us to classify it as fully acceptable. But we can not say that, laying aside considerations of cost and availability, we prefer it to copper. In fact, we do not like it as well as we do copper. But our preference for copper fails to support much of a premium on the price tag.

We believe that price and availability will make it THE distribution conductor material for a long time, perhaps indefinitely. Therefore we intend to keep looking for ways to further improve its applicability.

- Of particular interest to us now is the possibility of using compression connections, for less cost and better performance.
- Another need is for designs and devices that will facilitate use of aluminum for the larger sizes of secondaries and service required for heavy commercial load areas.

We anticipate that these and other important developments will come rapidly as our industry starts using aluminum conductor in greater quantity. Present enforced curtailment of copper usage may indeed prove to be a blessing. By the time that supplies of copper again become available, many of the fears about aluminum will have vanished and full economic advantage will be taken of it as a competitive distribution conductor material.

Early Use . . . Our experience with steel reinforced aluminum, as transmission conductor dates back 25 years. No. 4 ACSR has been used on our rural distribution lines during the past 15 years and substantial amounts of No. 1/0 ACSR was installed on rural lines 20 years or more ago.

Five years ago, the probable saving

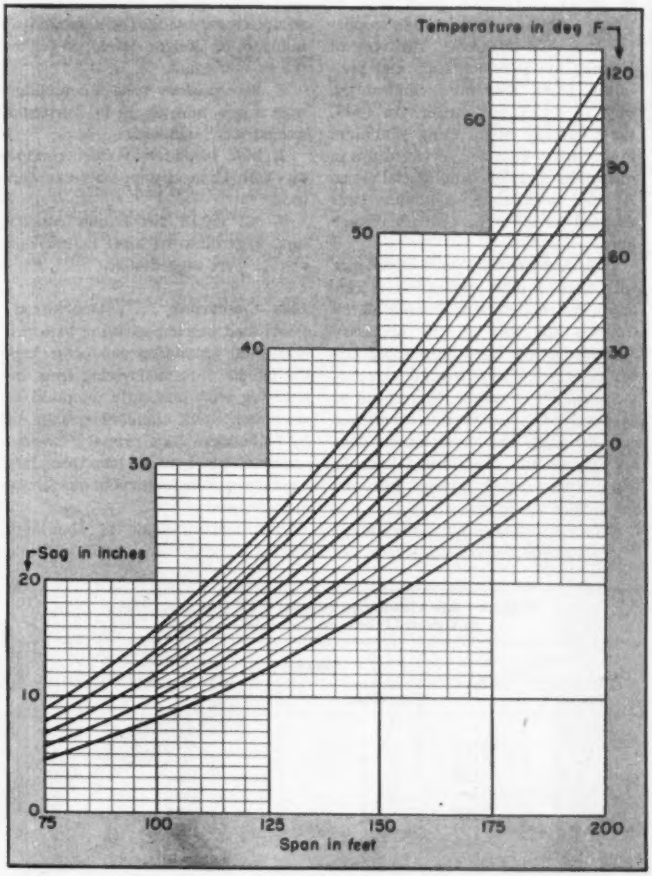


FIG 1—STRINGING SAG for all conductors used in urban short span construction follows this Universal Sag Chart regardless of the size, material or the voltage that is involved

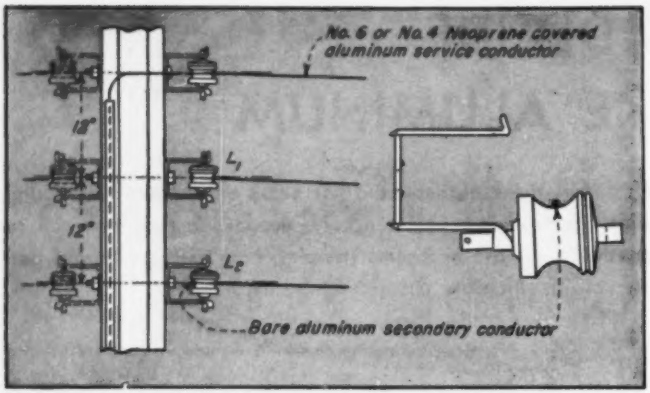
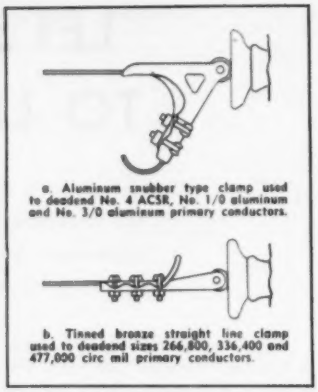


FIG 2—SAGGER-TYPE BRACKETS facilitate the stringing, sagging and tying in of aluminum secondary conductors, on tangent structures, before rotating spools 90 deg into final position



a. Aluminum snubber type clamp used to deadend No. 4 ACSR, No. 1/0 aluminum and No. 3/0 aluminum primary conductors.

b. Tinned bronze straight line clamp used to deadend sizes 266,800, 336,400 and 477,000 circ mil primary conductors.

FIG 3—DEADEND CLAMPS for primary conductors used in urban construction

in urban distribution plant cost by using aluminum rather than copper became very apparent. The cost of keeping our previous fears and prejudices about aluminum climbed too high to justify any longer. In 1947, the Company began using aluminum in secondary lines and service drops in residential and light commercial areas. At the same time, aluminum was adopted for all urban primary voltage lines.

Four and one-half years experience with such a new application is certainly not enough to experience all the troubles and find all the necessary answers. There have been some difficulties. A few steps toward improvement have been taken. More need to be developed. But overall experience has been such that the Company does not foresee any likely trend back to copper until either relative price or availability so dictate.

Before deciding to use aluminum in urban distribution, certain general design premises had become generally accepted and used. These exerted an influence on designs developed for the use of aluminum.

1. Bare primary voltage conductors with a minimum of 29 in. horizontal spacing were standard.

2. Bare secondary voltage conductors with 12 in. spacing on racks were used.

3. All urban distribution conductors, regardless of size, material or voltage were sagged alike.

Line Conductors . . . Our already established practice of using bare primary and secondary conductor kept the matter of wire covering from interfering with our early adoption of aluminum. Our standard spacing of 29 in between bare primary conductors and 12 in. between bare secondary conductors were retained in our aluminum designs.

Sizes and stranding of aluminum and ACSR conductors listed in Table I are now considered standard for overhead distribution in our urban areas. Copper equivalent sizes are used exclusively in order to eliminate economic and critical material waste of aluminum used to extend existing copper circuits. All sizes are sagged in accordance with the Universal Sag Chart shown in Fig 1. It has been used for 13 years and permits all urban conductors to be sagged alike regardless of size, material or voltage. By following this practice we do not hesitate to install aluminum or ACSR circuits on poles already carrying copper circuits.

This sag chart was originally developed to stress No. 6 hard drawn weatherproof wire, in a design span of 150 ft. to 60% of its ultimate strength under heavy loading conditions. The original chart was retained after bare copper conductor became standard for additions to our system. No. 6 bare, hard-drawn copper sagged with this chart is stressed to 50% of ultimate strength under heavy loading conditions in a 150-ft span.

Minimum Size . . . Smallest aluminum conductor, without steel reinforcing, that is used, is based on the premise that its safety factor under heavy loading, must be equal to or better than No. 6 bare hard-drawn copper. Calculations shown that No. 1/0 all aluminum is the smallest that meets this requirement. Sagged according to the chart, it is stressed to 41.5% of ultimate under heavy loading conditions in the design span. Thus its performance under heavy loads is expected to

Table 1—All-Aluminum and ACSR Conductors Used in Urban Overhead Distribution Lines

Wire Size	Type	Strands		Covering	Copper Equivalent
		Alum	Steel		
*6	Alum	1	.....	Neoprene	8
*4	Alum	1	.....	Neoprene	6
4	ACSR	7	1	Bare	6
1/0	Alum	7	.....	Bare	2
3/0	Alum	7	.....	Bare	1/0
266,800	Alum	7	.....	Bare	3/0
336,400	Alum	19	.....	Bare	4/0
477,000	Alum	19	.....	Bare	300,000

* For service drops only

be slightly better than that of No. 6 hard-drawn copper which has been considered acceptable for many years.

We recognize that the sagging of aluminum by charts developed for copper can be challenged. However, we believe that from a practical standpoint, the practice is acceptable as long as both conductor materials are in use.

A comprehensive study,* in 1947, to determine the most economical secondary conductor size, material, transformer size, loading and spacing found No. 1/0 aluminum most economical for a wide range of residential load densities and conditions here. It was entirely coincidental that this same size aluminum wire was the smallest, without steel reinforcing, that has satisfactory strength for urban distribution under our design premises. Today its use on our system is quite extensive.

Another economic study, based on conditions found in several of our larger towns, showed that 477,000 circ mil all-aluminum was most economical for 4,160-v feeders that started half loaded and eventually became 300 amp feeders. Many circuit miles of this size and type conductor have been installed in primary feeders on the system during the past four years. About 80 miles of this conductor was recovered from an abandoned electric railway system when it had been used some 40 years as a trolley feeder. It was found to be in generally excellent condition and reusable with only a relatively small amount of repair and waste.

A recent review of the economics of 4,160-v feeder conductor size, recognizing changes that have occurred in some of the cost factors since the original study, points to a smaller size feeder conductor than 477,000 circ mil aluminum. It is probable that future 4,160-v feeders will be built of 336,400 circ mil all-aluminum.

Sagging Practice . . . All-aluminum conductors sagged according to the Universal Sag Chart of Fig. 1 are stressed under heavy loading conditions in the design span as follows:

Conductor Size	% of Ultimate Strength
1/0	41.5
3/0	35.6
266,800	29.4
336,400	27.4
477,000	25.5

We have had only one glaze storm of near heavy loading severity since we started using all-aluminum conductor. A storm in early 1949 was rather wide spread through three operating divisions. We know of no case where all-aluminum conductor failed or had to be resagged after the storm.

It is generally conceded that aluminum, being softer and lighter than copper, requires more care during installation to avoid abrasion and knicks. No accurate information is available on what this means in higher installation cost. But crew foremen estimate that the cost increase is a matter of only a few percent of the labor cost of installing equivalent copper.

No armor is used on either primary or secondary conductor attachments on tangent structures. No. 7 AWG strong aluminum alloy tie wire is used for making insulator ties. Sagger type brackets, Fig 2, are used to support the secondary conductors on tangent structures. These facilitate pulling the conductor into place, sagging it, and tying before rotating the spools 90 deg into permanent position. Three-inch insulator spools are used on the sagger racks on tangent structures.

No. 1/0 aluminum and No. 4 ACSR are spliced with twist sleeves. Larger sizes of aluminum are splaced with compression sleeves.

As stated earlier, we generally use aluminum (and ACSR where needed for strength) for all primary voltage applications. Its usage for secondary voltage distribution has been restricted to residential and light commercial areas. Copper is still used in heavy

* AIEE Transactions—1949 Vol. 68, p 433-436.

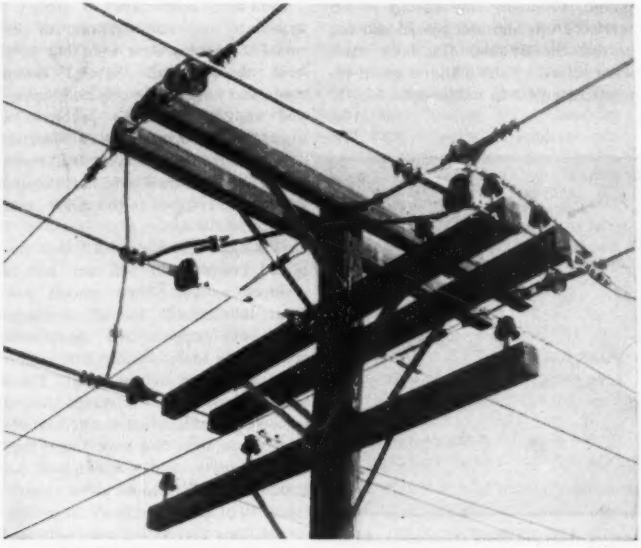


FIG 4—CORNER POLE showing arrangement of 477,000 circ mil bare-aluminum on 4-kv feeder

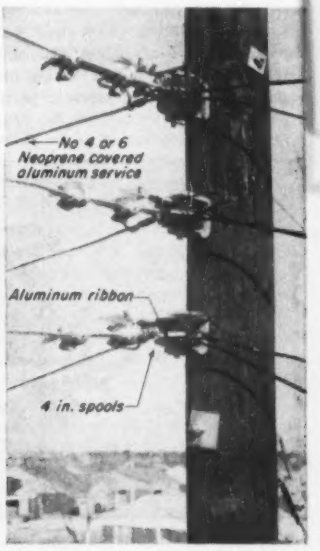


FIG 5—SECONDARY DEADEND with 1/0 Al

commercial areas for secondary circuits, principally because of the mechanical and clearance difficulties involved in terminating and making the many service connections to the larger secondary wire sizes. It is possible that costs and material availability will later increase the use of aluminum secondary in these heavier load applications.

Primary and Secondary Deadends . . . Primary conductors of sizes No. 4 ACSR, 1/0 aluminum and 3/0 aluminum are deadended on aluminum snubber type clamps of the type shown in Fig 3(a). Sizes 266,800, 336,400 and 477,000 circ mil aluminum are deadended on tinned bronze straight line clamps of the type shown in Fig 3(b). Choice of the two clamp types has been determined largely by market availability. The conductor is not wrapped with ribbon at primary deadends. Current carrying connections are preferably made to the conductor tails, Fig 4, rather than to the portion of the conductor under tension.

Secondary deadends are made on 4 in. insulator spools as in Fig 5. We wrap the conductor with flat aluminum ribbon at these deadends. Need for 4 in. spools is not definitely established. We started using them at the same time we started using aluminum wire for secondary lines and have had no occasion to change. They provide a larger bending radius and are thus somewhat easier to use.

Service Drops . . . Residential and small commercial service drops installed during the last several years have generally been No. 4 and 6 single strand hard-drawn, Neoprene covered aluminum conductor. Larger services have been made of copper because of mechanical and clearance difficulties involved in terminating the larger service wire and in making connections to these services.

Solid aluminum service conductor is used rather than stranded because:

1. The same size solid copper conductors have been satisfactory in the past.

2. We believe less trouble will result from use of split-bolt connectors than with solid conductors.

Two types of trouble have been had that may be all or partially due to use of solid wire for service drops. In a few cases the aluminum conductor has parted within the Neoprene covering. But the covering is so strong that the service drop does not fall to the ground. Cause of these breaks has not been established. The conductor may have been kinked or the break may have been due to a minufacturing defect. Percentage wise this type of trouble has been inconsequential.

The second type of trouble has not been experienced in urban construction. Trouble arose from vibration transmitted to the customers' premises through solid aluminum service drops. Two cases have been reported. Both involved secondary spans where ACSR was used in spans of 300 ft or more. Vibration was sufficient to cause complaint. Changing the tension in the service drops and secondaries did not correct the trouble. But both cases were solved by the addition of an intermediate pole to reduce span length.

Our designs provide that service drop connections be made to a No. 4 solid aluminum service bus as in Fig 6, rather than to the secondary line wires. This service bus is connected to the secondary by a two-bolt, three piece tin-plated bronze crossover connector. We have not been fully successful in getting this design used by our field installation forces, but we are convinced that it will provide a more trouble free installation.

Connectors . . . Principal source of trouble so far with aluminum distribution construction has been from connectors. Most of the trouble has occurred at points of heavy current concentration such as connections from transformer secondary leads to secondary conductors. Connections from secondary conductors to groups of service conductors not made in accordance with present design described in the previous paragraph have also caused trouble.

Tin-plated bronze split-bolt connectors with plated spacers are used for connections of small aluminum-to-aluminum, aluminum-to-copper and copper to copper conductors, except at connections to the customer's entrance wires. Here plated service connectors equipped with plated spacers are used.

The current carrying parts of all connections are coated with No-Ox-Id "A" at the time of installation.

Split-bolt connectors of different materials and combinations of bimetallic washers were used but have been discontinued. Several dozen types and kinds were originally specified and bought. The problem of maintaining proper stocks of materials and the difficulty of keeping field crews adequately informed as to the intended application resulted in too many cases of incorrect usage.

Our experience indicated that tin-plated bronze split bolt and service connectors with plated spacers perform satisfactorily for all combinations of copper and aluminum connections under atmospheric conditions prevailing in our area. These will continue to be our standard until some better connection method or device is available. We have found that standardization and simplicity of instructions that are to be given to field forces is of top importance in getting installations correctly made with aluminum conductors.

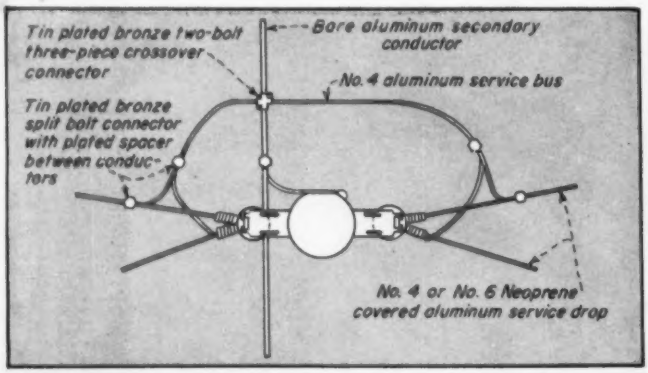
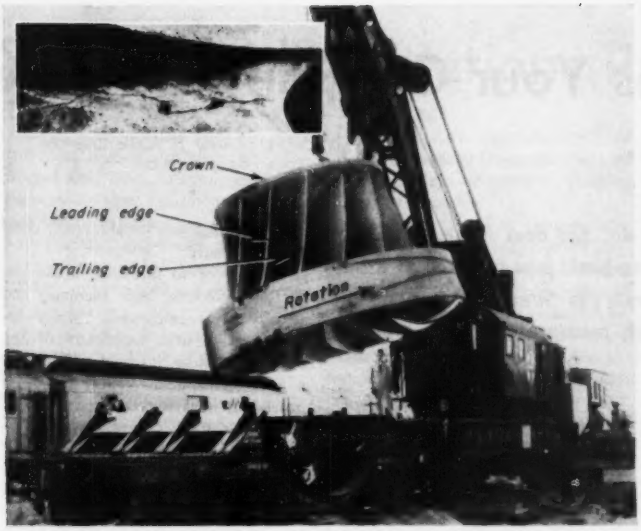

Tin plated bronze two-bolt three-piece crossover connector
Bare aluminum secondary conductor
No. 4 aluminum service bus
Tin plated bronze split bolt connector with plated spacer between conductors
No. 4 or No. 6 Neoprene covered aluminum service drop

FIG. 6—SECONDARY CONSTRUCTION used on tangent structures where aluminum conductor is employed. Service drop connections are to No. 4 solid aluminum service bus



VIBRATION CRACKS show clearly (inset) where blade joins crown of 60-ton runners from units at Parker Dam. Vortex trails at trailing edge of blade caused vibration

DEVICES for finding cause of vibration included sensitive diaphragm

Runner Modification Stops Vibration

D. L. GOODMAN, Engineer
U. S. Bureau of Reclamation, Denver, Colo.

Modification of turbine runners by sharpening trailing edges to increase vent openings and improve flow conditions remedied vibration and cracking which would have required replacement of entire runners at the Bureau of Reclamation's Parker Dam. The modifications also stepped up plant capacity by about 6%. Basic data derived from analysis of the test results are now valuable precedents for future designs of large turbines.

Three years after installation of the four 40,000-hp turbines, intense vibration of the 60-ton runners caused the start of progressive cracking of the turbine runner blades. Investigation of the first unit revealed that 14 out of the 15 runner blades were seriously cracked near the crown of the runner. Pitting action of the high velocity flow of water at sub-atmospheric pressures had also gouged out critical areas of metal.

First repairs consisted of chipping out cracked and pitted areas and partially filling the cavities with a mild steel welding material. Remainder of the pitted areas was filled with stainless steel rod, and ground to the proper contour. But cracks appeared again.

Subsequent attempts to remedy the vibration included sharpening the runner blade leading edges, installing metal stuts between adjacent blades, admitting compressed air into various runner parts, trimming edges of wicket gates, and finally, complete rewelding of the broken runners using stainless steel welding rod. Although the repaired runners had considerably greater strength, they cracked in the same location about as fast as before.

To minimize further cracking, operators in August, 1948, limited water flow to eight-tenths of full gate opening. This limitation continued until the problem was solved in 1951.

To determine points where vibrations occurred, the Bureau launched a comprehensive field testing program in early 1950. Sensitive pickups and special cells to measure pressure, strain, and acceleration were installed. An extensive network of test apparatus was placed throughout the turbine runner and related water passages. Electrical impulses from this apparatus was taken out through collector rings on the turbine shaft.

Tests showed conclusively that the only possible source of the vibration was the trailing edge of the runner blades. It was recommended that the trailing edges be sharpened, reducing the weight of each blade by 20 lb. This reduced correspondingly the intensity of the transverse vibratory force acting on the runner blades. At the same time it increased the vent opening and improved flow conditions past the critical trailing edge. From a theoretical standpoint smoothing the approach surfaces and squaring the corners of trailing edges eliminated alternating pressures set up by vortex trails (zig-zag eddies of water).

Inspection of the runner following test runs showed that vibration set up by the vortex trails at trailing edges was eliminated. It also showed that concern over possible cavitation caused by the larger opening between blades was groundless.

Does Your Company Have A

H. S. METCALFE, Director of Public Relations
West Penn Power Co, Pittsburgh, Pa.

. . . Most of us think we do! But does it measure up to today's need? Does it do the three basic jobs required of a balanced program? Does it encompass the three vital components of a workable plan? To find out, measure your own program against this standard.

All of us have public relations. Most of us have reason to hope or assume that they are good. We feel generally that the public accepts us—that it does business with us willingly on a reasonably friendly basis. We may recognize certain weak spots in our public relations, but believe that we have ample facilities for putting out local fires should they develop.

But the question today is: Do we have a balanced public relations program for employees, our public and our stockholders that—

1. Keeps them fully informed of policies, problems, and activities affecting them?

2. Keeps them aware of the part we play as citizens in our communities and in the American competitive business system?

3. Keeps them actively enlisted on our side in warding off attempts to control or expropriate our industries?

A balanced public relations program must, of course, be predicated on fair treatment of employees and on a policy of sincere dealing with our customers in matters of sales and service.

Beyond these prerequisites, however, there are four major elements that are vital in developing a sound public relations program.

A. Sound employee relations built with an informed group of loyal workers.

B. Good customer relations insured by intelligent understanding of company and industry operations and problems.

C. Cooperation of stockholders and their families.

D. Strong community relations involving a shared citizenship.

Welding the four elements into a workable public relations program obviously calls for top management concurrence on policy, qualified personnel capable of administering both the policy and program, and wholehearted cooperation of all executives and supervisors in accepting responsibility individually for the parts each must play in the program.

With these thoughts in mind, let us look at each of these four basic elements in turn, together with some of the techniques and materials available to implement them. In so doing, I will, of necessity, draw heavily upon our own experience at West Penn Power Co. But practices and devices will be included which have been found helpful by others in the utility field.

A. Good Employee Relations.

This first element is absolutely basic to good public relations. Employees are the backbone of utility service. They are the front line guardians of any company's reputation. They can be the company's foremost ambassadors of good will, or they can be breeders of discontent and misunderstanding in the community.

If they understand the problems facing the company or industry—if they are acquainted with basic policies and operational procedures—if they are aware of threats to the industry because of encroaching government competition and control—employees can be intelligently vocal on their company's behalf.

Employees so informed about the matters affecting their company are usually loyal employees. Many become enthusiastic supporters of the company's cause, inspired with almost a missionary zeal. This has been proved in numerous instances in the utility industry.

It is vital, then, to our public relations program that we develop a thorough, continuing employee information program, utilizing the many successful communications techniques available. Although these may be familiar to most of you, let us review some of them.

1. The employee handbook or manual which serves to indoctrinate new employees on basic company policies and operations can also act as a refresher for older workers.

2. The employee magazine or newspaper is an excellent channel for a steady flow of information about company policies, operations and problems; also on collectivist threats to our industry and economy. Source material on these broader matters for employee publications is readily available today from industry groups and from the many agencies engaged in programs on economic and political education.

3. Literature on industry, business and general economic matters can be placed in employees' hands. A variety of distribution methods may be used. Much useful material is so detailed or technical that it need be only routed to supervisors. On the other hand, some literature is so generally understandable that it can be distributed to all employees. Material dealing specifically with company or industry matters can be appropriately mailed to employees' homes with a letter from the president. Other types of leaflets and pamphlets may be placed in literature racks or left in crew rooms for employees to pick up at their own inclination.

Adapted from an address on the subject by the author, given before the New Jersey Utilities Association at Absecon, N. J., on November 16, 1951.

Strong Public Relations Program?

Books, fairly detailed booklets, and articles of a kind not normally distributed widely can be circulated from company libraries set up in strategic work locations. There are many easy-to-read, stimulating books and articles available today on economic and political subjects that are suitable for this purpose.

4. Supervisors, because of their positions and generally higher interest level, will normally read more comprehensive information about company and economic issues. Special supervisory news bulletins can be distributed quickly and easily. Supervisors generally appreciate being informed ahead of their employees and the public on matters of importance.

5. Training programs now regularly include periodic meetings of supervisors to discuss such matters as problems of management, company operations, human relations with employees, and economic and political fundamentals.

It is becoming apparent that similar types of discussion meetings can be held very effectively with the majority of a company's employees on such subjects as company structure and operation, basic economics, and political ideologies. Problems of training leadership and presenting acceptable material have been met successfully within this past year by a number of skillfully developed packaged programs. Most of these are sufficiently flexible for adaptation to local conditions and individual needs. Programs are currently available from such agencies as Middle West Service Co, National Association of Manufacturers, Ross Roy, Inc, University of Chicago, American Economic Foundation, Brookings Institution, Harding College, and others.

6. Bulletin boards in enough locations to reach the majority of employees are an obvious and simple channel not to be overlooked in any employee information program. Large, colorful and compelling posters are available from several commercial sources, at a price. However, much good posting material is readily available in the way of company and industry advertising reprints, and home-made mimeograph, silkscreen or offset posters. In addition, employees can be encouraged to post items they read and clip from periodicals such as articles and cartoons dealing with current business, economic and political themes.

7. In the visual education field there are now a number of good movies and film strips on basic economics and politics available from many sources. They may be shown either in training programs or at informal employee meetings and parties.

It is worth noting that many employees can be enlisted in active participation in their own information programs. Such volunteer effort capitalizes on their interests and channels their energy into useful activity. Employees can perform helpful functions as operating the "fan-out" system for literature distribution, monitoring bulletin boards, manning libraries, operating projectors, scheduling and chairing discussion meetings.

Employees enlisting in an information program tend to become the best informed, and therefore the most enthusiastic, ambassadors of a company's cause. Thus they are builders of good public relations.

Four Major Elements Vital To Development of A Public Relations Program

- **Sound employee relations built with an informed group of loyal workers**
- **Good customer relations insured by intelligent understudying of company and industry operations and problems**
- **Cooperation of stockholders and their families**
- **Strong community relations involving a shared citizenship**

B. Good Customer Relations

This second element can only be insured by an intelligent understanding on the part of those who use our service of the many and varied problems that are facing our companies and industries.

Most of us recognize that when we are faced with increasing our rates to customers, or making other major changes in policy, it is wise to prepare and follow a thorough-going program for getting the public's understanding and support. Much attention is given to training contact employees, publishing advertisements, releasing newspaper articles and mailing carefully worded statements on the matter involved. In the main, such efforts have paid off in the way of improved public relations at the crucial time of any important operational change.

Seemingly today we have an equally good opportunity for winning our customers' continuing support on some of the broader, long-range issues that affect our business. We need thousands of supporters who sincerely believe that our companies are operated on sound business principles, for the service of the public, with rates that are established fairly. Fortunately we have channels through which to carry such convincing messages:

1. Employees who normally contact customers can be given special training to make them able evangelists for our company and industry.

2. In addition to sales messages, our established publications going to customers can well carry advertisements, editorials or news items concerning company operations and industry achievements or problems.

3. Newspaper advertisements, telling either a company or industry story, are a means of driving home important truths customers should know about our business.

4. Newspaper publicity articles can be based on local issues affecting in-

dividual companies, or they can report national trends through the mouth of the local industry spokesman.

5. A variety of good radio programs are available for local sponsorship which provide opportunities for doing a job of political education or discussing individual company problems. One example of the broad educational type of program is "Speak up, Americans!" produced by America's Future, Inc, of New York, featuring John T. Flynn and other leaders in the national picture. Another is "The Freedom Story," a weekly broadcast series by Spiritual Mobilization of Los Angeles.

6. Cooking schools, appliance demonstrations, and other promotional meetings held with customers give opportunity for showing short movies or injecting a few words to urge support of company objectives or of our highly productive enterprise system.

7. Nearly all advertising to customers lends itself to at least a brief emphasis on the business-managed character, and taxpaying citizen role played by our businesses and industries.

Informed, sympathetic customers become more than just the source of revenue. They are valuable supporters of our company and industry objectives.

C. Cooperation of Stockholders

The third element depends on stockholders and their families' appreciation of management's problems, and the efforts made to solve them. Here I must speak more from observation than actual experience, since only a small block of my Company's common stock is in public hands. We do, however, have some 6,088 preferred stockholders. But those of you with widely held securities have both a good audience and ample channels for reaching it—to win friends and supporters whose interest can be deepened considerably beyond their anticipation of the quarterly dividend check. For example:

1. Many companies send letters of welcome to new security holders, giving a brief explanation of the products manufactured, the services rendered, and the aims and policies of the management.

2. In recent years attractive annual reports often go beyond the required formal statements and give the stockholders an understandable interpretation of company's operations in terms of service and the human element. Today it is by no means uncommon for the president's letter in an annual report to cite industry problems and reflect upon the effect of government control or competition.

3. Enclosures sent with quarterly dividend checks are used by some companies to discuss various phases of company operations in addition to reporting current financial conditions.

4. Stock holder meetings, held in local areas, where a reasonable audience can be expected, have been used with considerable success by a number of corporations. At such meetings, usually the president and other officers report informally on company progress and answer questions which may be asked. Products, services, markets, operating methods and problems are discussed, often with the assistance of charts, demonstrations, displays or other visual aids. Such close grass roots contacts help to increase a stockholder's sense of personal ownership and interest in the business.

Though they may be primarily interested in the return on their investment, stockholders can be enlisted in active support of our cause.

D. Strong Community Relations

The fourth and final element requires a company to accept its share of local citizenship responsibilities. As service industries, our success depends largely on the growth and welfare of the communities in which we do business. It is to our advantage to develop in every way we can the economic strength and moral character of the areas we serve.

In most communities we already have the foundations on which to build a reputation for being a good citizen —a power plant, a pumping station, a service building, a business office or at least a few employees residing locally.

These conditions create many opportunities to emphasize the company's role of citizen. For example:

1. Participation by key employees in civic affairs through active membership in local community organizations.

2. Leadership of welfare and charity drives such as the Community Chest and Red Cross.

3. Financial support of worthwhile causes on a fair, explainable basis.

4. Leadership in the work of character-building, rehabilitation and youth agencies.

5. Promotion of territorial development by working with other community interests to attract and locate new industries.

6. Plant tours, where feasible, for thought leaders and other community groups to show how your business operates and how your employees work.

7. Where available, offering company property for community recreational or civic purposes.

8. Providing business office window or floor space for displays by scouts, 4-H clubs and other groups.

9. Making demonstration kitchens or other assembly rooms available for womens' club and other meetings.

10. Maintaining a Speakers Bureau to supply speakers and films for the programs of all types of public groups. From your executive and supervisory group a corps of qualified speakers can be trained. A wide variety of speech material can be developed, ranging from discussions of detailed company operations to matters of economics and American citizenship.

Motion pictures can be informative as well as entertaining. In addition to industry films, there are many good movies dealing with economics, ideologies, and citizenship responsibilities.

11. Providing local newspaper editors with special material not for publication, but as background on company and industry problems.

12. Cultivating a list of thought leaders in the community, such as the clergy, educators, editors and civic leaders, and sending them appropriate information.

13. The public's esteem can be enhanced by publicizing, without boasting, the many things a company does for a community besides supplying a necessary service. Many of these can be publicized in terms of people, thus arousing a feeling of human warmth toward the company.

Activities such as these create an awareness of the important part the company and its employees play in the ongoing life of the Community, and of the values in a citizenship shared mutually by the company and the public.

Organizing a Program. Do you have a public relations program? I am sure you are already using some,

perhaps many of the elements just reviewed. Perhaps they are even a part of a long range plan and policy. On the other hand your public relations may have developed out of emergency and expediency over the years. If this is the case, now is a good time to restudy your public relations and organize the present elements into a sound, forward-looking program. In so doing, you will want to follow four distinct steps:

1. Determine Your Objectives. This first step is in terms of major principles such as rendering adequate service, bettering your communities, treating your employees fairly, and preserving the American private business system.

Put your objectives down in writing and broadcast them throughout your entire organization. Refer to them frequently.

2. Build a Plan. Study carefully the present state of your public relations. Determine if your current practices fit in with your stated objectives.

Analyze your existing facilities for communicating with the public, employees and stockholders. Are the channels open both ways?

Prepare your plan of action, using the techniques and media discussed earlier, to overcome weak points you may have discovered.

3. Establish Responsibility. Policy and authority should be crystal clear. The over-all responsibility for seeing that your public relations objectives are met naturally falls on the chief executive of the company.

For the actual conduct of your public relations program, the president would appoint an experienced executive. In addition he will set up lines of liaison between departments so that all elements can be correlated and coordinated under the public relations executive.

4. Measure the Effectiveness of Your Public Relations Activities. Knowledge of how your public relations stand, now and at any given future time is extremely important. Checks with various department heads and discussions with field representatives can give you a reasonably accurate indication of your strength and your weak spots.

However, a more comprehensive and scientific yardstick is the public attitude survey conducted and analyzed by an experienced agency.

Elements of a Utility Public Relations Program With Suggested Supporting Activities

Basic Elements	*Suggested Activities and Materials Needed*
Employee Relations	
1. General education on company and industry problems	1. Use readable literature; libraries, reading racks. Make reference to industry problems in employee handbook. Prepare employee magazine articles, cartoons or editorials. Use bulletin posters.
2. Training in company operations, basic economics, and public relations problems	2. Hold discussion meetings with employees. Have area conference with employee groups on public relations. Implement with available industry material. Use packaged programs, additional literature and films from outside agencies.
3. Plant visits	3. Make available to all employees, perhaps on a share-cost basis, if expense is a factor.
4. Union recognition	4. Give greater publicity to Union affairs, contract signing, etc. Request cooperation in projects where they can contribute appropriately.
5. Clear communication channels	5. Start Questions from Readers in employee magazine. Run invitation articles from some more vocal down-the-line supervisors. Report interviews with executives on policies involving public relations.
a. Suggestion system	a. Install or revitalize system, with promotion slanted toward "get yourself a piece of this company"
6. Attitude surveys	6. Conduct an employee attitude survey with some questions on public relations. Run results in employee magazine and emphasize public relations problems.
Customer Relations	
1. General customer information on company policies, and services available	1. Send letter welcoming new customers; also folder explaining services, something about company, and policies regarding employment, improvements, etc. Use regular publicity in customer publications.
2. Customer contacts	2.
a. Personal contacts	a. Train all contact personnel in techniques of courteous intelligent treatment.
b. Correspondence contacts	b. Review Correspondence Manual, spot-check field correspondence. Occasional bulletin on better letters. Modernize letterheads.
c. Bill forms	c. Make bills readable and understandable; humanize, as with Reddy Kilowatt messages.
d. Delinquent and cut-off notices	d. Test effect of a "sprightly" delinquent notice, such as those carrying Reddy Kilowatt.
e. Rate change notices	e. Make notices as personalized as possible; fully explain company's problems.
f. Customer publications	f. Include company service beyond promotional services; discuss public relations matters.
3. Talks, demonstrations, film presentations	3. Add more general features regarding company and industry problems, including economics and citizenship.
4. Plant visits	4. Extend opportunity for visits to more customer groups, clubs, etc.
5. Publicity and advertising	5. Work more of human element of company and services into publicity and advertising. Quote officers on national problems. Run display advertising on industry or company problems. Publicize personnel changes more consistently and well down the line.
6. Attitude surveys	6. Conduct survey of customer attitudes and check with national trends. Expand activities in areas where more progress is needed.
Stockholder Relations	
1. Welcome letters to new stockholders	1. Send letter with information about company and its services, map of area served, etc.
2. Annual reports	2. Humanize annual report; discuss economic problems affecting company.
3. Dividend enclosures	3. Include a few interesting statements about company activities and problems with dividend checks.
4. Area meetings for stockholders	4. Hold when occasion warrants, inject human aspects of the business.
5. Attitude surveys	5. After a period of above, check attitudes with survey.
Community Relations	
1. Community planning	1. Study communities and assume leadership—or give substantial support—in planning.
2. Industrial development	2. Encourage cooperative community activity; also carry on direct solicitation of industries, if necessary.
3. Cooperation with civic and other local associations	3. Be represented in all responsible, active groups. Have local personnel represent company in all worthwhile activities.
4. Support of community-wide cultural and philanthropic interests	4. Give leadership and financial support to worthwhile projects, making certain position is defensible.
5. Plant visits	5. Invite municipal authorities and appropriate community groups.
6. Publicity and advertising on community activities	6. Publicize community events and company's part in them.
7. Contacts with newspapers and radio stations	7. Keep close personal—or correspondence—contacts with newspaper editors and advertising managers, radio and TV station managers and commentators, supplying background on company's problems.
8. Contacts with community thought-leaders	8. Mail literature and background material to clergy and educators.
9. Attitude surveys	9. Check any customer attitude survey as to community thinking.

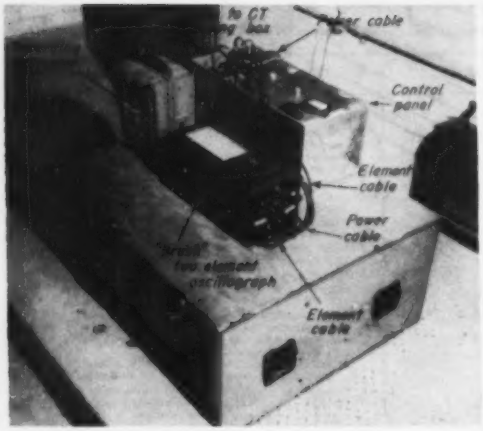


FIG 1—PORTABILITY of equipment was effected with padded plywood packing case on which oscillograph and other equipment are seen here set up and ready to record

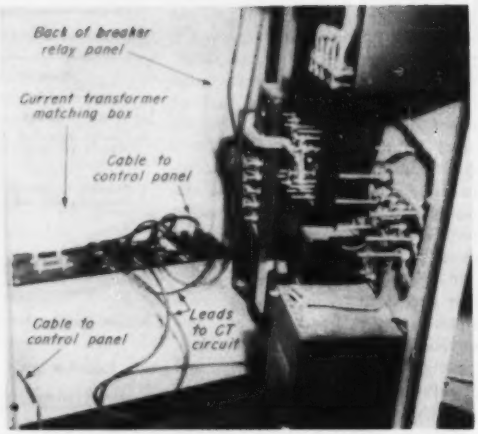

Back of breaker relay panel
Current transformer matching box
Cable to control panel
Cable to control panel
Leads to CT circuit

FIG 2—C.T. MATCHING BOX was set up behind breaker panel with cables to control panel and current transformer circuit. Four-conductor, 200-ft. cable permits convenient location of oscillograph

Transient Phenomena Studies Made Easier

By **W. T. MORRIS**, Engineer, and
B. M. GALLAHER, Engineer,
Texas Electric Service Company, Ft. Worth

Direct writing oscillograph fills gap between recording voltmeter-ammeter and photographic oscillograph methods. Uses to which it can be put "seem unlimited" . . .

Recording and study of transient electrical phenomena has been made easier by a new type oscillograph that writes directly on paper with ink. This instrument not only does away with photographic processes but also fills a gap between the recording voltmeters and ammeters and the more precise and elaborate photographic type of oscillograph. Results have been generally satisfactory within the desired accuracy requirements of utility application.

Heart of the new device is the two-element, direct-writing oscillograph. The galvanometer is directly connected to a light-weight pen capable of following each cycle up to a speed of approximately 120 cycles per sec. The chart paper is driven by a motor through reduction gears with three optional chart speeds. The oscillograph element records approximate full chart deflection with 20v applied. To couple the normal output of a conventional current transformer secondary to the oscillograph elements, a multi-tapped saturating current transformer and matching network unit was designed and built. Calibrating facilities together with manual and automatic control are combined in a control unit which effectively becomes a switch board and plug board panel.

Serves Many Purposes . . . Originally the direct writing oscillograph was bought for verification of short-circuit calculations of distribution circuits. However its flexibility and portability have lent themselves to many other needs

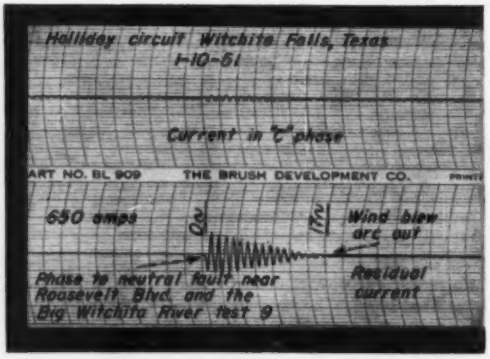

Holliday circuit Witchita Falls, Texas
1-10-51
Current in "C" phase
ART NO. BL 909
THE BRUSH DEVELOPMENT CO.
650 amps
Wind blew arc out
Phase to neutral fault near Roosevelt Blvd. and the Big Witchita River feet 9
Residual current

FIG 3—WIND BLEW ARC OUT on 650 amp fault and direct writing oscillograph recorded current flow

and the uses to which it can be put seem never ending. Here are some of the tests that have been made.

1. Staged short-circuit tests measuring current magnitude and duration in conjunction with selective-fuse-breaker coordination on distribution circuits.
2. Verification of published fuse characteristics.
3. Sequence of breaker and relay operation. It has been very useful in adjustment of relays for very short intervals of time. This supplements the use of the conventional cycle counter.
4. Motor-inrush current and concurrent voltage dips.
5. Adjustment of circuit breaker closing coil current.
6. Study of random faults occurring on distribution circuits. This is accomplished by automatically starting the chart motor and running it at high speed for a predetermined length of time. All except the first three cycles are recorded.

Limitations of the direct-writing oscillograph should be understood in order to utilize it most effectively. Maximum recording frequency for the instrument is approximately 100 cycles per sec. For this reason wave shape of the recorded transient is not discernible.

Design Controls . . . The control and matching network were designed with several objectives in mind. Flexibility of current ranges was sought particularly so that conventional current transformer secondary output would produce approximately full scale deflection on the chart from 5- to 100 amp of current transformer secondary. Intermediate current ranges were provided. Voltage measurement was matched so that approximately 140v gives full scale deflection when one of the elements is switched to "voltage."

It was especially desired that the equipment be easy to set up. All connections are multi-contact Jones plugs or similar except that the main current input connections are rugged calibrating studs. A built-in Variac and ammeter provide calibrating facilities. Under normal conditions two men can remove the oscillograph from the packing case, set up, make connections, run calibration and be ready for tests within 15 min. This compares very favorably with the longer time required to set up photographic types of oscillographs and calibrate them.

Portability of the equipment was effected with a padded plywood packing case. Ink, tools, spare pens, and leads together with the matching network unit, control unit and oscillograph are firmly bedded in their respective compartments in the packing box. Over a thousand miles of automobile haulage apparently has not damaged the equipment appreciably.

Several safeguards were built into the control and matching units to minimize the "ignorance factor." Neon tubes prevent excessive current, or voltage, producing "off scale" operation. The tube for each element is adjusted to "fire" at approximately full-scale deflection and the tube circuit loads a portion of the matching transformer, thereby, reducing the voltage on the oscillograph element. As presently used, there is no positive knowledge of when the neon tube fires unless correlated circumstances indicate such functioning. During several tests this safeguard has protected the equipment.

The matching unit and the control unit are interconnected by a small flexible four-conductor cable through which the two elements and initiating elements are fed with maximum currents of approximately 14 milliamps. Accidental breaking or opening of this cable does not "open-circuit" the primary current transformer secondaries or materially alter their burden. This four-conductor cable permits more convenient location of the oscillograph and control unit up to 200 ft from the current matching network unit. The current matching network unit is generally located as near the current transformer secondaries as possible to minimize extra burden and accidental secondary "open-circuits."

Record Interesting Phenomena . . . Some interesting phenomena have been recorded during the past year. They include:

1. Interruption of 900 amp 12.5-kv short-circuit, by wind, Fig. 3.
2. Self-clearing fault on 12.5-kv circuit.
3. Inrush motor current following a 19 cycle interruption on a 12.5-kv distribution circuit whose principal load was large induction motors, Fig. 4.

Takes Out Guess Work . . . The direct writing oscillograph and associated equipment have taken the "guess work" out of many of the more common measurement problems which do not justify use of the conventional photographic oscillograph when a simpler instrument is available.

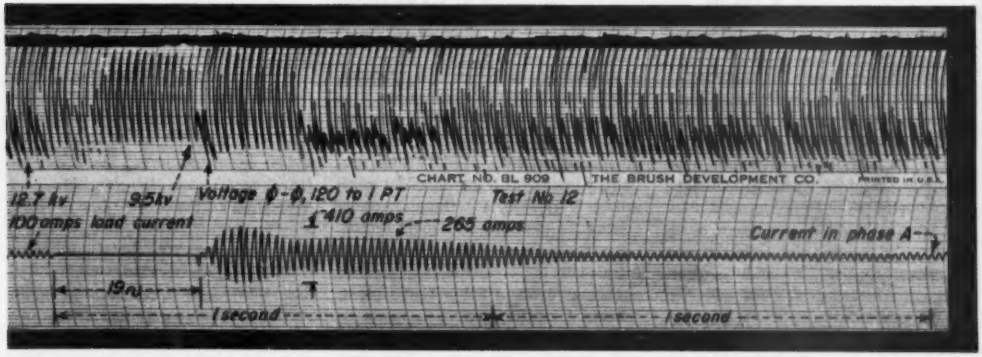
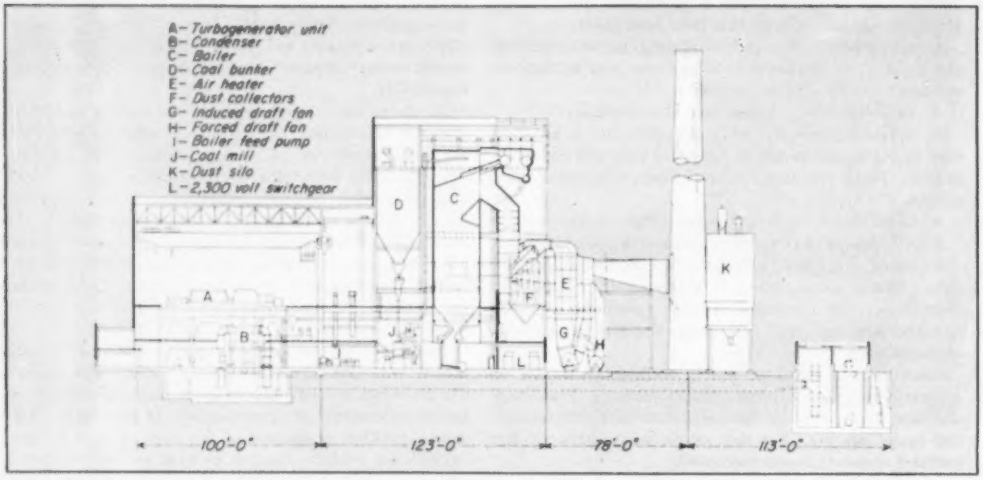
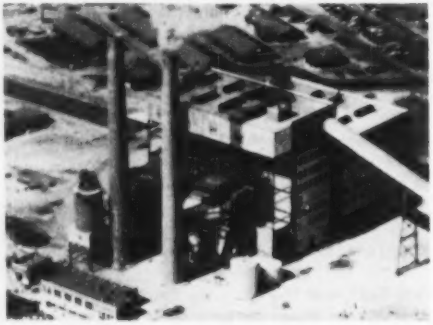


FIG 4—MOTOR INRUSH CURRENT following 19 cycle interruption on 12.5 kv circuit whose principal load was large induction motors was recorded easily and effectively as these charts from a direct writing oscillograph show



TWO OPERATING LEVELS in a horizontal plant arrangement that facilitates access to equipment for efficient operation and maintenance were prime objectives in the design of Delaware Power and Light Company's new Edge Moor generating station. Initial installation comprises two 60/66 Mw units. Semi-outdoor design was chosen for other reasons beside the small net saving in building cost



OUTDOOR BOILERS at Edge Moor plant contribute to operating comfort, cut cost

Edge Moor Station

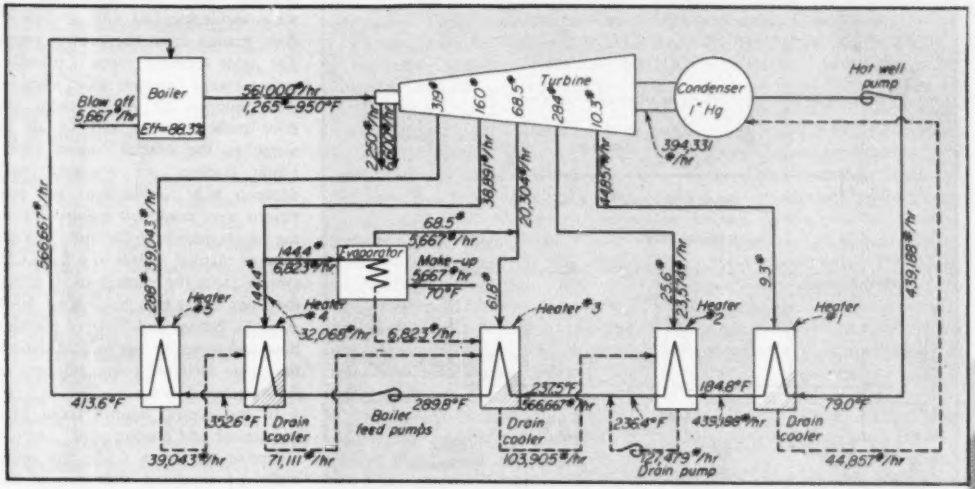
Two-level plant of semi-outdoor construction has central control room, double auxiliary bus system, deaerating hot well integral with condenser and variable-speed feed pump drive. Two-unit plant serves local industry load and interconnections through 12-kv and 69-kv buses

C. F. DIXON, Supervising Engineer, and **R. C. HAMMERQUIST,** Electrical Engineer
United Engineers & Constructors Inc, Philadelphia, Pa.

Edge Moor steam-electric generating station of Delaware Power & Light Co has been designed to serve local loads as well as to deliver reliable output to the area interconnection. Design was therefore aimed at achieving these objectives in an economical manner compatible with maximum availability. In meeting these aims it was necessary to use two induced-draft fans, two forced-draft fans and two auxiliary transformers for each boiler-turbogenerator unit, also provide a ring bus to achieve flexibility for supplying local 12-kv industrial load and in operating the two 60/66 Mw preferred standard turbogenerators.

There are five significant features of the design: (1) Separation of the air preheater into primary and secondary sections, (2) measures for minimizing corrosion, (3) liquid rheostat control of induced-draft fan speeds, (4) a deaerating hotwell virtually integral with the condenser and (5) two operating levels in a horizontal plant.

Special efforts were also made to attain the greatest economy in power and control cable runs. This was done by locating the 3750/5000-kva, 2300-v, 3-phase, station service transformers and switchgear in two rooms below the dust collectors which is the load center between the station and pump house motors. These service transformers are the dry type, are supplied by filtered air of a constant volume, are provided with fixed CO_2 fire protection and have automatic closing dampers in the air supply ducts. The 440-v station service and house service motors are served from four 500-kva dry-type transformer metal-clad unit substations and seven metal-clad motor control centers located in



HEAT RATE expected at this unit type plant is 10,100 Btu per kwhr gross for a unit load of 67,951 kw. Two initial unit rated 60/66 Mw use steam at 1,250 psi, 950 F. Boiler output at this load is 561,000 lb per hr. Innovation is two-stage deaerating storage hot well in condenser that reheats the condensate with steam passed through the condenser, and also raises the water temperature in the hot well

Serves Both Local and System Load

the open and in their load centers. Motors 150 hp and above are 2300-v. All others are 440-v.

The 60/66 Mw turbogenerator steam conditions are: Pressure 1250 psi and temperature 950 F without reheat. Expected thermal performance is 10,100 Btu per kwhr gross.

Semi-outdoor design was chosen for several reasons other than the relatively small net saving in building cost. One reason was to put the large radiating surfaces of the steam generators outdoors for operating comfort. The economizer, dust collector and air heater located outdoors normally require very little maintenance during regular operation.

Two-level operation was the objective in designing the building and arranging the equipment in it. Walls are brick and tile in two tones except for the temporary wall which is aluminum panels with glass insulation. Latter wall will be moved to a corresponding position when the third and fourth units are to be housed. Floor in the turbine area is confined to walkways around the units. This was done to improve air circulation within the building and reduce building costs.

Rotary Vacuum Pump . . . Rapid extraction of air from the condensing system is achieved by use of a rotary vacuum pump. This pump was chosen in lieu of use of steam in a hogging jet because it was felt to involve less loss of condensate than with steam jet air ejectors.

Deaerating Hot Well . . . An innovation was the adoption of a two-stage deaerating storage hot well virtually integral with the condenser. In addition to reheating condensate with steam laned through the condenser, means are provided for injecting steam at about 28 psig from the fourth extraction point to raise the temperature of the water in the hot well. In this way the hot well is designed to function also as a deaerating heater.

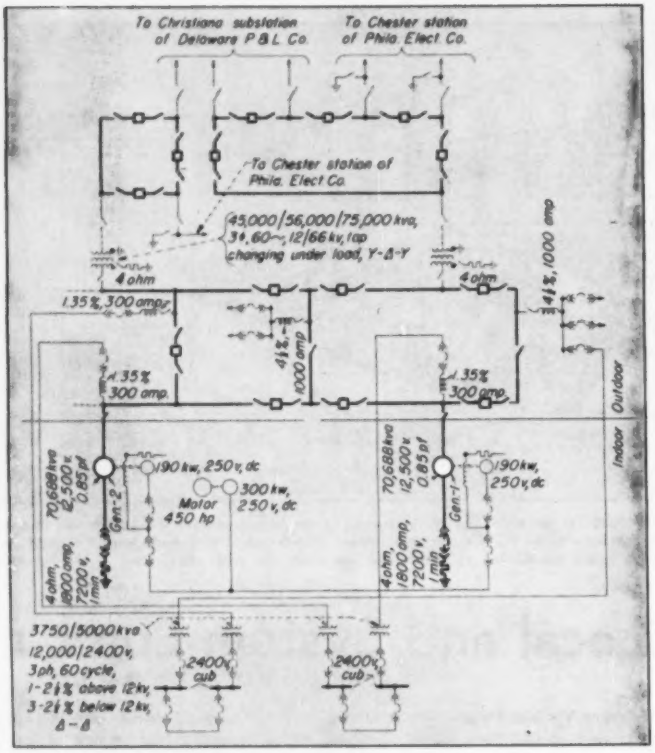
One heater is in the throat of the divided water box condenser to conserve space. There are five stages of heating and all the units are the closed type. Makeup is injected into the condenser.

There are two 10,000-gal overhead condensate tanks, one for each of the two initial turbines. Both tanks are filled from a common 100,000-gal condensate storage tank located outdoors. Water pumped to the overhead tanks is maintained at the desired level by automatic controls on the pumps.

Condensate in a closed system is used for cooling the hydrogen and the main bearings. Heat picked up in this process is transferred to river water through heat exchangers.

Speed regulation of the boiler feed pump is obtained by automatic control of the hydraulic coupling in response to a three-element drum level control. The motor is a 1,000-hp squirrel-cage unit for constant speed operation. Such regulation is conducive to good station net because: (1) The power consumption by the boiler feed pumps is lower than would be the case with the units pumping against the throttling pressure of a regulating valve, and (2) the response is better than obtained with a regulating valve. Layout is such as to afford direct vision of the illuminated gage glass from the operating floor in addition to automatic transmission of the drum level indications to the control room.

Dust Collector . . . At least two basic advantages were derived by placing


To Christiana substation of Delaware P & L Co.
To Chester station of Phila. Elect Co.
To Chester station of Phila. Elect Co.
45,000/56,000/75,000 kva, 3φ, 60~, 12/66 kv, tap changing under load, Y-Δ-Y
4 ohm
4 ohm
1.35%, 300 amp.
41%, 1000 amp
41%, 1000 amp
35% 300 amp.
35% 300 amp.
Outdoor
Indoor
70,688 kva 12,500 v 0.85 pf
190 kw, 250 v, dc
300 kw, 250 v, dc
Motor 450 hp
Gen-2
70,688 kva 12,500 v 0.85 pf
190 kw, 250 v, dc
Gen-1
4 ohm, 1800 amp, 7200 v, 3 cyc
4 ohm, 1800 amp, 7200 v, 3 cyc
3750/5000 kva 12,000/2400 v, 3ph, 60 cycle, 1-2½% above 12 kv, 3-2½% below 12 kv, Δ-Δ
2400 v, cub
2400 v, cub

DUAL FUNCTION of station is shown by bus layout. Local industrial load is served at generator voltage through two 12-kv ring buses. Tie to system is made via 69-kv ring buses

the mechanical cyclone-type dust collector between the economizer and the primary section of the air preheater. First, the flyash is caught before it can clog the air heater or erode the induced draft fan. Second, the gases are still well above the dew point as they pass through the dust collector and it, in turn, is protected against moisture, deposits and corrosion. Provision has been made for installing electrostatic ash precipitators into the breeching between the secondary section of the air preheater and the stack.

Induced Draft Fans . . . Each of the two induced-draft fans per unit is located between the primary and secondary sections of the outdoor air preheater. Again this places the fan in a slightly warmer zone and minimizes the risk of exposure to dew point corrosion. By using two sections of air preheater, it was possible to make the second section relatively short and therefore to be able to use aluminum alloy tubes for their superior corrosion resistance. Replacement, if necessary, of these shorter tubes should prove easier than the much longer tubes of a single preheater design. Using two induced draft fans and two air preheaters per boiler will also facilitate part-capacity operation. This refinement was dictated by the objective of having the plant provide firm reserve for the system with which it is connected.

In addition by-pass dampers have been provided in the air heater to permit deflection of flue gas, on cold days. This arrangement is to keep the exit gas temperature above the dew point and prevent corrosion.

Central Control Room . . . The control room is approximately 20 x 30 ft inside for the first two units. It is fully air conditioned. The area will be duplicated for the ensuing pair of units.

A cable terminal room is located directly below the central control room and is supplied with air through floor grating from the control room. The cable terminal room is provided with a smoke detector which continuously samples air in the room and floor cable trenches and sounds an alarm in the central control room. Floor gratings are equipped with dampers with fusible links and provisions were made for manually closing the dampers from the control room. Remote manual release of a fixed CO_2 system from the control room floods the floor cable trenches. Two 50-lb size CO_2 bottles and 50 ft of portable hose and projector are located outside the cable terminal room adjacent to the entrance doors.

In the central control room four instrument and control panel sections comprise the inner walls; the outer walls are insulated steel panels and form a passageway behind the instrument panels to facilitate mechanical and electrical maintenance. All controls and instrument transmissions are electrical or pneumatic.

Front wall of the central control room contains mechanical and electrical instruments essential for the operation of the two steam generators and turbogenerator units. Electrical indicating instruments for loading, synchronizing and exciting the two turbogenerators, and the instrumentation for the two main power transformers and four station service transformers, are located in the center of the front wall with the mechanical instruments on either side, one section for each unit. The mechanical instruments are of the same "hand" for both units and are arranged in starting-up sequence from left to right. Local panels serve the starting functions.

A benchboard contains a mimic bus of the two 12-kv ring buses, the control for the excitation and voltage regulation systems, control and instrumentation for steam generator auxiliaries.

An intercommunication system consists of loudspeakers and handsets conveniently located in the main operating area, at the local starting panels and the central control room.

The two side walls of the central control room contain such equipment as the alarm system, turbine supervisory instruments, less essential pressure gages and temperature recording instruments for the two units. The rear wall instruments are essentially

for station services. They are the controls for energizing the four 5,000-kva station service transformers and their respective switchgear buses, for battery distribution and for light indications for motor-operated valves and water treating equipment.

Control Room Lighting . . . Illumination is provided by a luminous translucent ceiling of 4-ft square corrugated plastic panels. Fluorescent tubes of instant-start characteristics give a minimum maintained 55 ft-c in the horizontal. Control affords two levels of illumination in order to maintain an average illumination of 60-70 ft-c. Observation of the indications is rendered non-glare by use of non-glare glass in the instruments and in addition the electrical instruments have non-shadow instrument cases.

Cable Trays . . . All control cables and 440-v power cables are installed in expanded metal cable trays. Expanded metal is counted upon more for light weight, economy and flexibility than for ventilation and heat dissipation by convection. The neoprene-jacketed cables so completely fill the trays that convection is negligible and only radiation can be relied upon for heat dissipation.

Expended metal cable trays are used also for installing the copper tubing for mechanical instrumentation.

In the 12-kv and 69-kv switchyard areas, control cables are neoprene jacketed and are installed in creosoted wooden troughs which were prefabricated in 8-ft lengths.

Station Function . . . Edge Moor power station is to supply local 12-kv industrial and distribution feeders, and power to the 69-kv transmission system of Delaware Power & Light Co and its subsidiaries, which system is interconnected by 69-kv ties with the Pennsylvania-New Jersey Interconnection at the Delaware-Pennsylvania and Delaware-New Jersey state lines. Flexibility of operation to assure availability of the installed capacity to the 69-kv system and local 12-kv feeders determined the selection of ring bus design with bus ties between the two 12-kv ring buses.

It was necessary to decide whether the 12-kv and 69-kv ring buses would be located adjacent to one another at the far end of the property convenient for interconnection into the 69-kv lines, approximately 2,000 ft from the power station, or whether the 12-kv ring buses be located adjacent to the power station to reduce to a minimum the 4,000-amp capacity generator circuits.

An economic analysis indicated that the shortest possible generator leads determined the location of the 12-kv ring buses because of their 4,000-amp rating and the fact that any structure for bare copper tubing on insulators or an underground duct run with insulated cable must be piled. The local 12-kv industrial feeders are underground in the switchyard area and then are carried on wooden pole structures with preassembled self-supporting type cable.

The logical location for the 12/66-kv, tap-changing-under-load, main power transformer was adjacent to the 12-kv ring buses. The 69-kv connections to the 69-kv ring buses are installed on H-frame wood pole lines which are protected by two overhead ground wires.

Generator leads are 4,000 amp, 14.4 kv, metalclad isolated-phase bus from the machine terminals through the turbine room wall and 3.5 in. extra heavy copper tube on insulators, open type construction, from a point beyond the wall to the two 12-kv ring buses.

12-Kv Buses . . . Both 12-kv ring buses are 3.5 in. extra heavy copper tube on insulators, open type construction. The 12-kv breakers are 4,000 amp, 1.5 million kva interrupting capacity, air blast type, with the air mechanism at the bottom of the breaker, isolated-phase construction and roof entrance bushings. The breakers are forced ventilated by a blower and replacable type dust filter thermostatically controlled. Only louvers in the breaker housing are in a small screened opening near the top for ventilating air exhaust. Air blast breakers were chosen to eliminate fire hazard and reduce maintenance time. Breaker disconnecting switches are 4,000 amp, gang-operated, mounted on the open structure key interlocked with the breaker mechanism and phase compartment doors.

The industrial feeder breakers are 1200 amp, 500,000 kva interrupting capacity, magneblast type in metalclad switchgear. Breakers are connected to the bus through 4.5% reactors which are open type cast in concrete. The breakers are equipped with three-shot automatic recloser type breakers.

Manual control of the breaker is from the breaker housing. The air blast breakers and industrial feeder breakers have supervisory indication in the system operator's office. The main power transformers have automatic water spray fire protection.

The generator, 12-kv ring buses and main power transformer bank relaying are located in the electrical control room adjacent to the outside wall of the turbine room near the 12-kv switchyard area. The electrical control room also contains the supervisory control panel for remote indications and recording and demand metering panels.

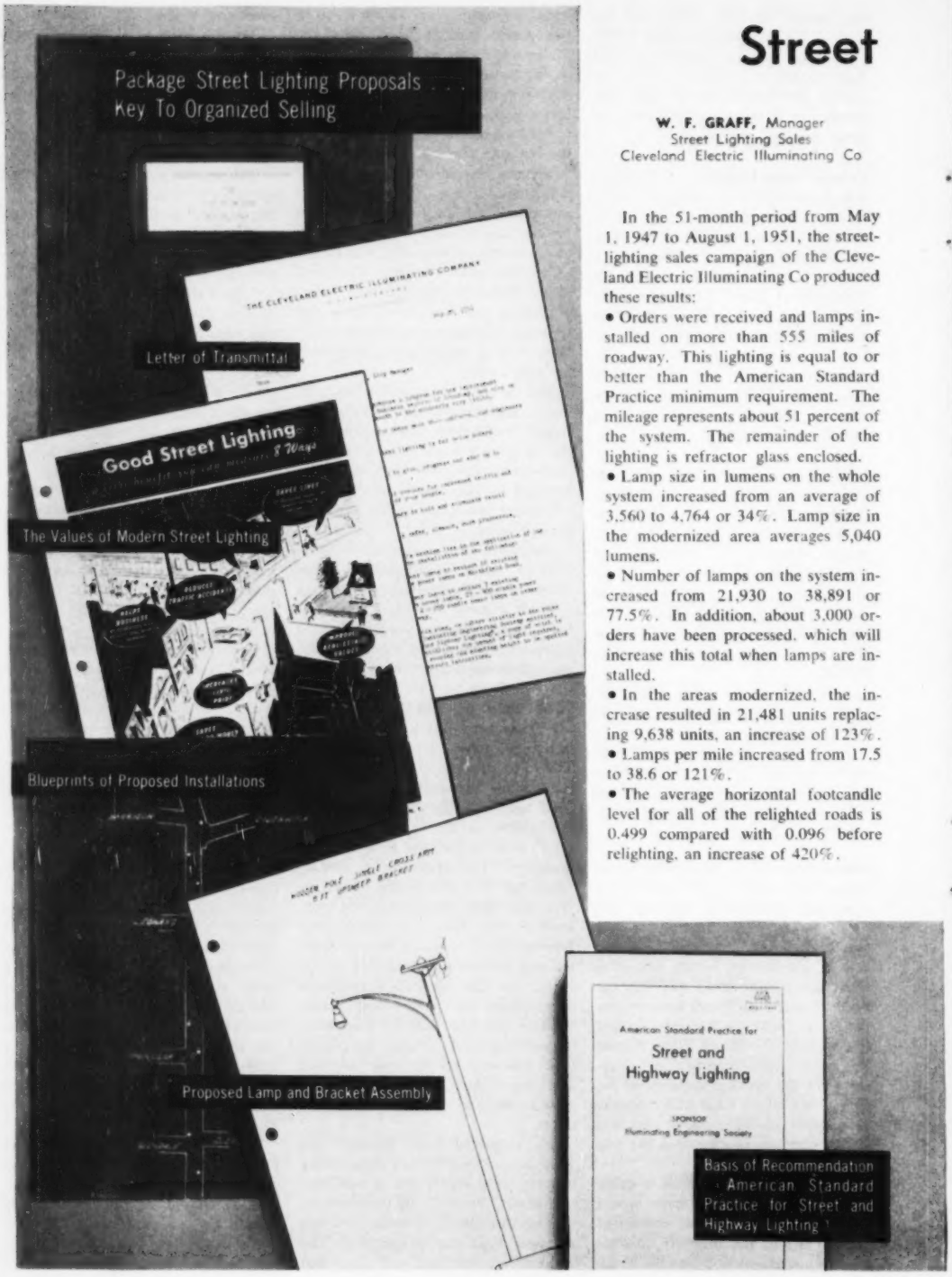
69-Kv Buses . . . The 69-kv ring buses are strain bus design. Circuit breakers are 1200 amp, 2.5 million kva interrupting capacity, oil type, with pneumatic operating mechanism. Oil circuit breakers were chosen because of the ample spacing of the 69-kv ring bus. Ring buses are 500 ft on one side by 200 ft on the other. Line disconnecting switches are 1,200 amp motor operated. Circuit breakers and line disconnecting switches are normally remotely controlled by supervisory control from the Christiana Substation of Delaware Power & Light Co. Supervisory indications are carried to the system operator's office. A small relay and control house is located adjacent to the switchyard area. The control house contains relay panels, substation battery and local control panels for emergency operation should supervisory control be non-operative.

Station Illumination . . . Turbine hall lighting is designed for 25 ft-c maintained with mixed incandescent and mercury type lamps. Lighting at the main equipment is designed for 10 ft-c maintained using dust-tight lighting units. Around the boilers and in the coal conveying system vaportight and dust tight conduit type lighting units are used. In the offices, assembly room and machine shop fluorescent units of instant-start type are installed of adequate lighting intensity for the work to be performed.

Switchyard area lighting is clusters of Type PAR lamps on 10-ft high steel posts installed in adjustable lamp holders. Flood lighting for the working area of the coal stock pile is installed on the roof of the power house and at the breaker house.

Street

W. F. GRAFF, Manager
Street Lighting Sales
Cleveland Electric Illuminating Co


Package Street Lighting Proposals . . . Key To Organized Selling
Letter of Transmittal
Good Street Lighting
The Values of Modern Street Lighting
Blueprints of Proposed Installations
Proposed Lamp and Bracket Assembly
American Standard Practice for
Street and
Highway Lighting
Basis of Recommendation . . . American Standard Practice for Street and Highway Lighting

In the 51-month period from May 1, 1947 to August 1, 1951, the street-lighting sales campaign of the Cleveland Electric Illuminating Co produced these results:

- Orders were received and lamps installed on more than 555 miles of roadway. This lighting is equal to or better than the American Standard Practice minimum requirement. The mileage represents about 51 percent of the system. The remainder of the lighting is refractor glass enclosed.
- Lamp size in lumens on the whole system increased from an average of 3,560 to 4,764 or 34%. Lamp size in the modernized area averages 5,040 lumens.
- Number of lamps on the system increased from 21,930 to 38,891 or 77.5%. In addition, about 3,000 orders have been processed, which will increase this total when lamps are installed.
- In the areas modernized, the increase resulted in 21,481 units replacing 9,638 units, an increase of 123%.
- Lamps per mile increased from 17.5 to 38.6 or 121%.
- The average horizontal footcandle level for all of the relighted roads is 0.499 compared with 0.096 before relighting, an increase of 420%.

Lighting Promotion DOES Get Results

Carefully organized sales activity proves that municipalities will accept modern standards of street and highway illumination

• C.E.I. is the first utility to report orders for Code lighting on every street in a city. (Cleveland Heights City with a population of 58,782 has 121.5 miles of lighted roadway. Lamps are now about 97% installed.)

Decision to Sell . . . Late in 1946, the company decided that the time had come to set up an active, inclusive campaign to promote a better standard of street lighting. This decision was influenced in part by rapid strides made over a period of recent years in the design and manufacture of street lighting equipment, and by the fact that previous sales efforts had been piecemeal and indefinite. A formula was published in February, 1946 by the Illuminating Engineering Society called "The Code of Recommended Practice of Street and Highway Lighting," and this formula was accepted as the sales plan. The company operates in an area of approximately 1,700 square miles, serving 135 political subdivisions with an estimated population of 1,520,000 people.

In the street lighting department, salesmen are assigned about thirty municipal accounts, and are responsible for maintaining regularly scheduled contacts. Using planned-program approaches, they work principally with municipal officials—the purchasing agents and the most direct sales influences for this type of product. Their activities also include other civic bodies such as chambers of commerce, safety, civic and fraternal groups, all of which are less direct but nevertheless forceful influences which must be factored into these campaigns.

Specific Proposals . . . Carefully prepared packaged proposals, tailored to fit the need of the particular area un-

Elmer L. Lindseth, President, The Cleveland Electric Illuminating Co, says,

"Street Lighting Is Good Business"

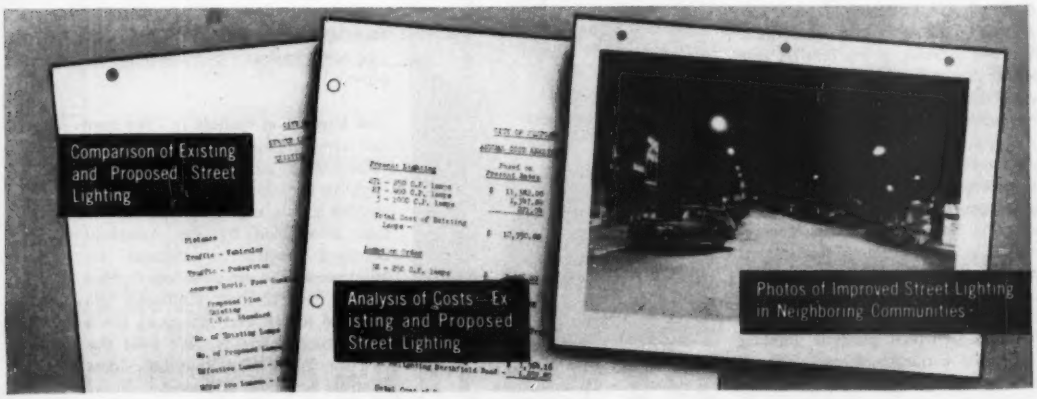
"Promotion of modern street lighting pays off. It helps to bring better public acceptance, better understanding, and better cooperation in respect to our entire operation. It is just plain good business. And it brings us the satisfaction that comes from knowing we have helped to make our service areas safer and more enjoyable for our customers.

"Electric utility companies have long believed that it is their responsibility to upbuild their service areas in all possible ways. They get behind all activities in the communities they serve which will make them safer, more attractive, and more prosperous.

"Modern street lighting is an outstanding example of such an activity. It cannot fail to improve the communities where it is installed. At the same time, it brings large dividends in public appreciation to both officials and the utility.

"During World War II, cities throughout the nation suffered from lack of attention to proper street lighting. The number of night traffic accidents increased everywhere, and crime was on the upgrade. Fortunately civic leaders in many communities became aroused to the situation. Hence, the street lighting people in the industry found a highly receptive audience when they inaugurated an intensified program for better street lighting.

"This achievement has brought the industry increased goodwill in tangible form from a number of segments of the public. Many of the letters received mention a key phrase: 'Your interest in community progress.' The industry has that interest, and we are happy it is recognized."


Comparison of Existing and Proposed Street Lighting
Analysis of Costs—Existing and Proposed Street Lighting
Photos of Improved Street Lighting in Neighboring Communities

History of Street Lighting Improvement in Cleveland Heights, Ohio

Type of Street	Number of Streets	Number of Miles of Street	Total Lamps Existing Prior to Relighting	No. of Lamps Per Mile Prior to Relighting	Total Lamps in Service After Relighting	No. of Lamps Per Mile After Relighting
1948 — Thoroughfares	10	17.3	506	29	773	45
1949 — Secondary Thoroughfares	23	20.0	332	16.6	1,028	51.4
— Special Residential	26	8.5	64	7.5	215	25.3
1950 — Residential Streets	210	75.7	747	9.9	1,875	24.8
TOTAL OR AVERAGE	269	121.5	1,649	13.6	3,873	32.0

der consideration, are an important part of the sales pattern. These proposals are prepared in accordance with the formula used in the EEI Sales Training Course. They outline the NEED, SOLUTION, ASSURANCE and VALUE of good lighting. The engineering parts of the proposals are prepared according to the "American Standard Practice for Street and Highway Lighting."

When assembled, the proposal package contains a letter of transmittal, an outline of the benefits that may be derived from good lighting, detailed prints and engineering summaries which show location, size and types of existing and proposed lighting, cost data and suggestions for funding, legislation and Committee reports, "before" and "after" photographs and other pertinent data designed to sell the program.

Sell Complete Acceptance . . . In presentations to municipal groups, the importance of installing the lighting as planned is stressed. We try to influence against deviating from the plans by emphasis during personal contact and by use of various promotional aids. As a result of the first 68 proposals that were made, all but one were sold in accordance with the recommendations.

A program of constant conditioning of the sales market is carried on by the Electrical League of Cleveland and other agencies who, in their own interest or in the interests of the general public, help to promote the sale of good street lighting. These promotions include advertisements, billboard and car-card advertisements, direct mail, publications which promote lighting either as a major objective or as one of a series of product lines, and addresses delivered to technical and civic organizations.

A Typical Case . . . To illustrate the acceptance of our sales programs, we cite our experience in Cleveland Heights, Ohio. This city has a population of about 59,000 people with 121 miles of improved streets. Before relighting, the system consisted of 1,649 glass-enclosed lamps with an average 5,300 lumens. In our discussions with the city manager, we outlined the advantages of a planned program, and were authorized to proceed with a lighting study. We made recommendation for a three-year program, which the city council approved and ordered installed. The accompanying table shows the details of the program, which was completed December 1, 1951. December revenue is estimated to increase from $75,000 in 1947 to $186,500 in 1951.

Crime Reduced . . . The street lighting that has been installed as a result of our continued sales campaigns and related promotional work has saved lives, reduced crime and decreased traffic accidents. Surveys taken by our official agencies and available for study will corroborate these facts. By the way of striking contrast, the Cleveland police department reports show a decrease of 31% in nighttime accidents, and an increase of 70% in day-time accidents for corresponding periods. A large number of crimes, falling among various types of personal molestations, purse-snatchings and robberies, have shown marked reductions. The Cleveland Crime Commission, in its recently released report states, "The present program of improving Cleveland street lighting should be continued."

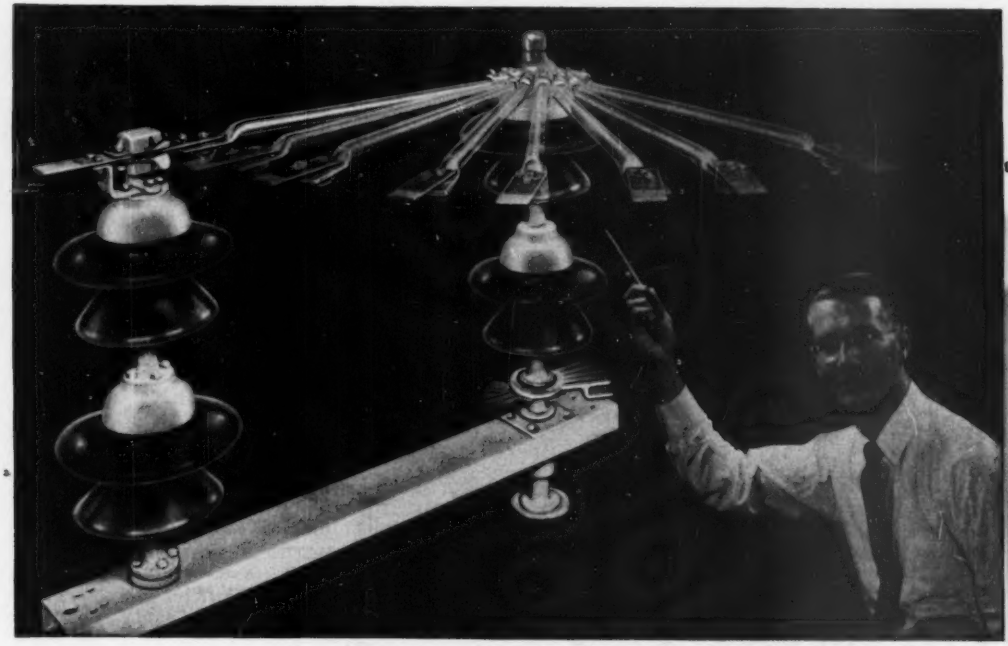
MODERNIZING street lighting is a continuous operation in CEI service area

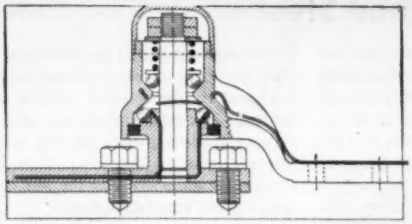
Merchants Profit . . . At the same time, better standards of street lighting have been largely responsible for upward trends in consumer business receipts and, as a result, a sometimes hard-to-define sense of civic pride has been stimulated in recent years by better street lighting. The Chamber of Commerce of Lakewood, a city with a population of 72,500, states, "The relighting of the business district has greatly stimulated business activity during the hours of darkness."

The contribution of the company to the general welfare of our customers is receiving recognition. Typical of the sentiments expressed by mayors of cities both large and small after relighting is this statement by the mayor of Euclid, a city of 41,000 people. He states, "We have refrained from comment, preferring to study the results and the reaction of the people in our community. We have now had an opportunity to study the results and make spot checks among our residents. The result indicates overwhelming approval."

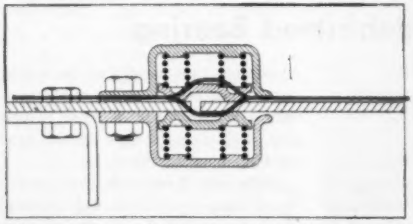
And Better Can Be Sold . . . We have had strong indication that the municipalities which we have helped to make "lighting-conscious" will approve and pay for a standard of lighting beyond that determined by the American Standard Practice as minimum requirements. We are confident that we can go back to these customers and continue to sell ever-increasing levels of lighting standards. We hold this as a principle that becomes self-evident as street lighting is improved.

Announcing...the New G-E Type RB side-break disconnecting switch





Schematic diagram of blade-pivot housing with current path indicated in red.



Schematic diagram of stationary contacts with current path indicated in red.

Current-carrying solid spheres replace troublesome flexible braid conductors

The new G-E Type RB side-break switch successfully eliminates the short-lived flexible braid conductor which is a frequent cause of switching difficulties and high maintenance costs.

In the new design, current passes through the hard copper spheres in the blade-pivot housing. These spring-loaded spheres provide a low-resistance path and at the same time assure effective pivot action by the blade actuating mechanism. A housing shields the spheres from ice and dirt accumulations, thus assuring trouble-free operation even under adverse conditions. The switch can be adjusted in the field so that blade opens either to the right or left to take full advantage of space conditions.

Other advantages include: shielding of the stationary contacts; silver-to-silver contact surfaces; direct-torque blade action—no cams, rollers or complicated linkages; and a minimum number of insulator supports per pole.

G-E Type RB switches are available in voltage ratings from 7.5 to 69 kv. For complete information, call or write your nearest G-E sales representative. *General Electric Co., Schenectady 5, N. Y.*

GENERAL ELECTRIC

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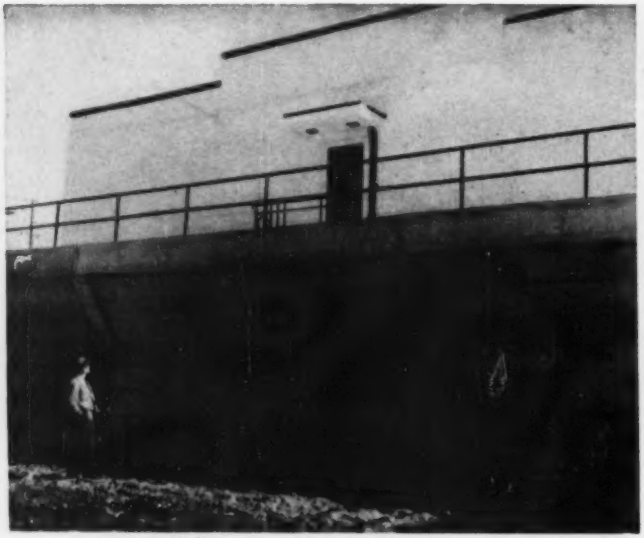


ANGULAR RETAINING WALL at Sperling substation of BC Electric is made of pre-cast units. Backward slope at the base reduces earth pressure on the wall; reversal of the slope at the top of the wall extends substation yard to the property line

SLOTTED DESIGN of counterforts helped to save 30% in use of concrete, 50% in use of reinforcing steel bars

Pre-cast Wall Units Save Concrete and Steel

Pre-cast concrete wall planks in pre-cast slotted counterforts on 12-ft centers saved BC Electric 30% of concrete material and 50% of reinforcing steel in a retaining wall at their new Sperling substation. Problem was to retain the edge of the substation yard right up to the property line, beyond which the foundation could not project. Sloping the wall backward over most of its height, with a reverse angle near the top allowed it to accomplish this objective with a considerable reduction in earth pressure on the wall.

Appearance of the substation from a main highway which passes immediately in front of it is considerably improved by the unusual contour of the wall. The angular inset provides a varying shadow pattern on the wall through most of the day, which is much more attractive than the conventional plane vertical surface.

Access Holes Save Resurfacing of Babbitted Bearing

CARL W. SMITH
Asst to Gen. Supt of Substations
Pacific Gas and Electric Co,
San Francisco

Drilling access holes in a line with plugged-up copper tubing cast in a bearing to carry cooling water enabled Pacific Gas and Electric Co to clean the tubing without having to disturb the bearing babbitt or cut and weld the tubing.

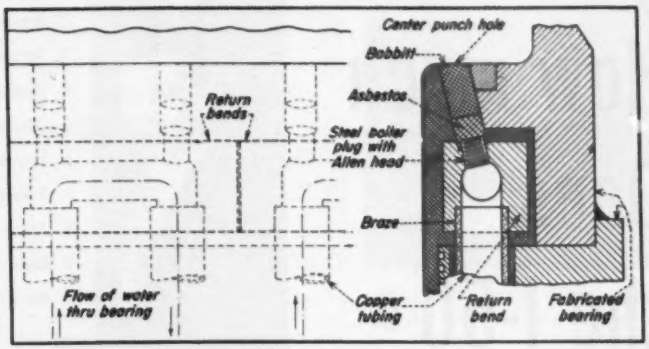
When operating temperature of the bearing cooling circuit increased sharply after two years of operation, inspection showed the cooling tubes to be plugged solid with a fine cement-like material. This was probably brought into the water cooling tower from a nearby cement plant together with yard dust. When 250-psi pressure and an acid solution failed to clear the tubes, the bearing was taken to the manufacturer.

Reference to the detail drawing of the bearing showed that the 1-in. outside diameter copper tubing was laid in straight runs parallel to the bearing axis. Ends of the tubing were brazed into a square piece of brass at each end, with a cored hole in the brass forming a return bend.

Both ends of each tube were opened by drilling a 9/16-in. hole through the outer end of the bearing, piercing the return bend in line with the tubing. After a passage through the sediment was opened with special tools, the tubing was cleaned with a piece of ⅜-in. plow steel cable which had a flared,

end that was chucked in an air drill.

Each of the holes was tapped with a pipe thread and a countersunk stainless pipe plug screwed in. After testing the complete circuit at 200 psi, the access hole in the end of the bearing was filled with new babbitt and counterpunched for easy locating during future operations.



ACCESS HOLES drilled in a straight line with clogged-up cooling tubes of this water-cooled bearing saved a major job of removing and recasting babbitt. Once holes were drilled, tubes were cleaned without disturbing babbitted bearing surface

Test 115-Kv Cables With 250-Kv Mobile Unit

JOHN C. PARKER
Light, Gas, and Water Division
Memphis, Tennessee

Trailer mounted, 250-kv, dc cable test equipment is being used by Memphis Light, Gas and Water Division to test recently installed 115-kv pipe type cables. The portable equipment was obtained for less than the cost of installing two permanent test sets required for the three cables. It eliminates the need for additional permanent test sets when more 115-kv cables are installed.

The Division has found the high-voltage dc test to be the most practical test known today for detecting defects in power cable circuits. It does not produce progressive deterioration of cable insulation. It will not produce a partial failure of insulation.

By separate purchase and construction of a standard test set and trailer and accessories, the cost was less than half what it would have been for a completely assembled set. The equipment has rated dc outputs of 250 kv and ¼ amp; 125 kv and ½ amp; and 62.5 kv and 1 amp. It may be operated with rated output voltage from a 200 to 260-v, a 2.4-kv or 7.2-kv power source. However, to secure rated current, a 2.4-kv or 7.2-kv source is required.

The trailer has a metal partition at the point where its floor drops. All high voltage equipment is located behind this partition. The control panel is directly in front of the partition. Doors are provided in the partititon only for access to the rear of the panel. A wire glass window over the panel board permits the operator to view the high voltage equipment. An enclosure in the front section holds power supply transformers and accessories. Also located there is a switchpanel for light, heater, fan and receptacle circuits. Reelites are provided for the low voltage power supply and for grounding the test set.

To provide adequate electrical clearance with minimum trailer size, a 12-ft telescoping section was installed in the walls and roof of the trailer. This feature eliminates the usual bushing for the high voltage output. Heaters and ventilators in both sections of the trailer prevent condensation. A fan in the control section makes summer operation practicable without discomfort to the crew.

These modifications in the standard dc cable test set have been found advantageous:

1. Relays reurn the output voltage regulator to zero when the test set is de-energized for any reason.

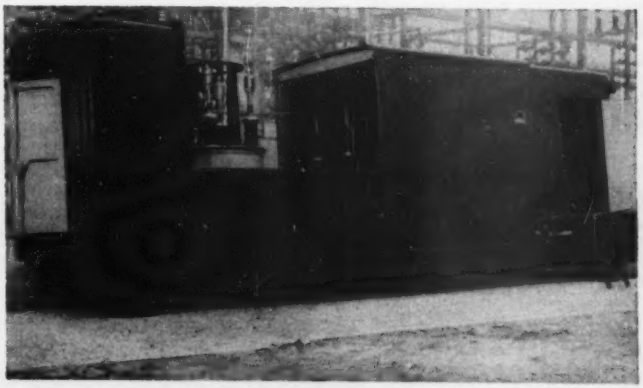
2. Flashing red lights visible from anywhere outside the trailer warn when the high voltage is on.

3. Installation of a recording output current instrument with fuse and film cutout protection and automatic chart control.

4. An instrument for recording the output voltage has been added.

The only difficulty experienced, in addition to moving the trailer in heavy traffic, has been with discharging re-

(*Continued on page* 108)



HIGH VOLTAGE TEST SET in trailer allows Memphis utility to test several 115-kv cables with one unit. Equipment consisting of standard dc cable test set with modifications proved more economical than purchase of equipment constructed to special requirements

How much Does the I-50 Save?

Average Saving
1 Greater sustained accuracy $1.17
2 Improved thermal qualities .04
3 Reduced potential circuit losses .15
4 Magnetic-suspension system .30
5 Avoids noise complaints .03
6 Less damage from corrosion .10
7 Reduced lightning losses .10
8 Fewer reading errors .01
9 Easier to repair .04
10 More dependable performance .06
Total possible saving $2.00

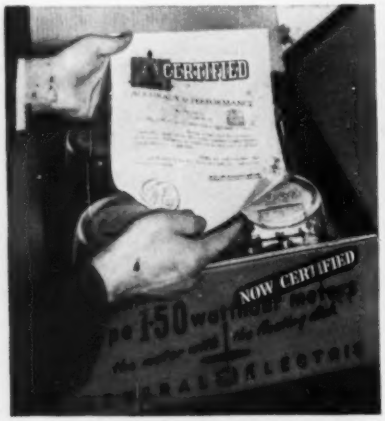
10 Possible Savings Offered By Certified I-50 Meters

Here are ten possible savings offered by each General Electric I-50 watthour meter. These ten opportunities to reduce metering costs represent, we believe, conservative estimates.

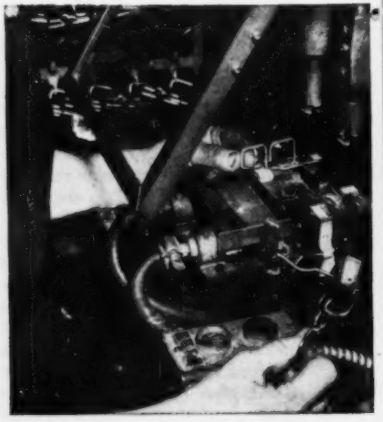
Detailed information about the method of estimating each saving has been printed in an easy-to-read, easy-to-understand bulletin . . . together with a description of the product features which make the savings possible. Why not send for the bulletin and study the savings in the light of your own experience. We are sure that you will prove to yourself that substantial cost reductions can be made. General Electric Co., Schenectady 5, New York.

GENERAL ELECTRIC

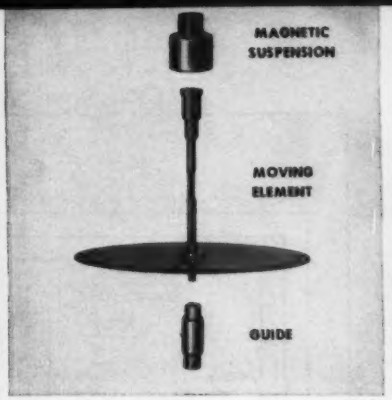
Only certified I-50 meters offer all these savings:



1 GREATER SUSTAINED ACCURACY and certification provides opportunity for reducing acceptance tests—longer time between periodic tests. Estimated saving . . . $1.17.



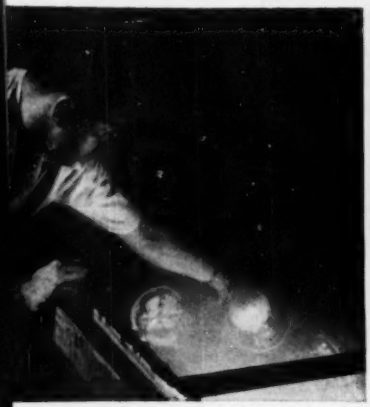
2 IMPROVED THERMAL DESIGN assures fewer failures. Brazing current terminals (above) plus butyl insulation also result in saving . . . $0.04.



3 **REDUCED POTENTIAL LOSSES,** paid for by utility, are lower than those in other meters. Resistance check, shown above. Estimated saving per I-50 . . . $0.15.

4 **MAGNETIC SUSPENSION SYSTEM** (floating disk) eliminates bearing wear. Conventional bearings may need replacement at least once during life of meter. Saving . . . $0.30.

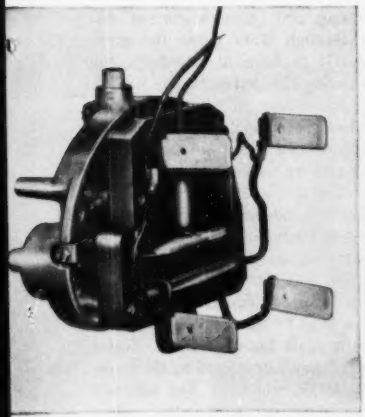
5 **AVOIDS NOISE COMPLAINTS.** Floating disk plus position of retarding magnets assure quiet operation as proved by noise test Saving . . . $0.03.



6 **LESS DAMAGE FROM CORROSION** saves cleaning, painting, repair bills. Salt spray tests, above, prove I-50 is corrosion resistant. Saving . . . $0.10.

7 **REDUCED LIGHTNING LOSSES.** I-50's pass final high potential test at 3000 volts. Molded insulation for impulse strength; relief gap away from insulation. Saving . . . $0.10.

8 **FEWER READING ERRORS** because both types of registers have large numerals and glass cover that permits wide-angle reading. Estimated saving . . . $0.01.



9 **EASIER TO REPAIR,** I-50's have stator-and-frame-assembly exchange plan that speeds seldom-needed repairs. Few ever returned. Estimated saving . . . $0.04.

10 **MORE DEPENDABLE PERFORMANCE.** All I-50's must pass 18 electrical tests, 356 points of inspection. Factory certifies 99.9% free from defects. Estimated saving . . . $0.06.

Mail This Coupon Today For Complete Information

Please rush my copy of "10 Ways that I-50 Meters Save" (GEA-5727) containing specific details of each saving.

Also, send brochure describing meter certification (GED-1408)

Section 601-81
General Electric Company
Schenectady 5, N. Y.

NAME .....

POSITION .....

COMPANY .....

ADDRESS .....

CITY ..... STATE .....

Testing 115-Kv Cable

(*Continued from page* 105)

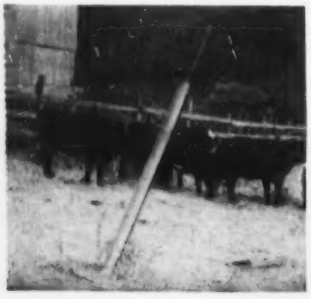
sistors. It is difficult to discharge five miles of cable to which 250 kv has been applied.

In the design of future test sets, consideration should be given to a guard circuit to bypass leakage current over test lead supports, over the external surfaces of one cable terminal, and around the output current instrument. This would permit more accurate determination of the dielectric absorption and polarization index of the insulation of underground power cable installations.

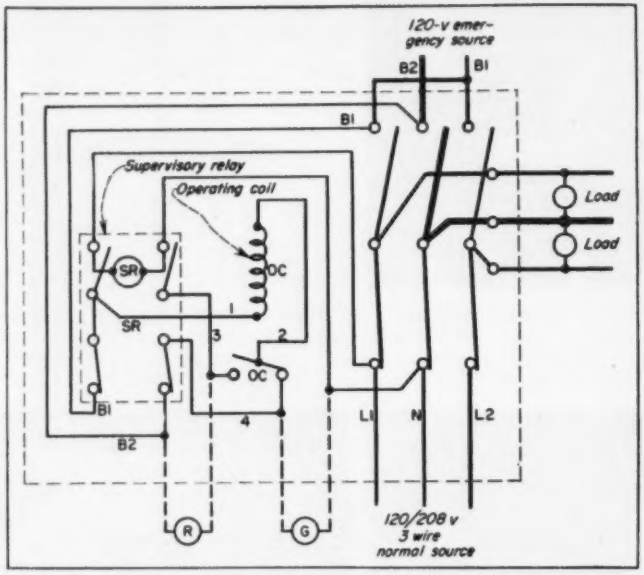
Fiber Guy Guard Safeguards Cattle

A fiber conduit guy guard which prevents cattle from strangling themselves on guy clamps has materially reduced the number of law suits against Virginia Electric and Power Co from prize cattle owners. It seems that cattle neck chains easily get caught in the guy clamps. A feature of this guard is that it is easily installed by one man in about 15 minutes.

The guard is an 8-ft length of 4-in. conduit which has been split by a circular saw. The guy wire is inserted in one end of the split and the conduit pushed up until the guy wire is totally enclosed. For rigidity, about 6 in. of one end of the conduit guard is buried in the ground; the other end and middle are wrapped with friction tape. The operating department of the Virginia Electric and Power Co developed this application of fiber conduit.



GUY GUARD made from fibre conduit prevents prize cattle from getting their neck chains tangled in distribution guy wire



INDICATING LIGHTS added to electrically operated, mechanically held automatic transfer switch show which source is feeding load. Green light (G) indicates normal source is connected; red light (R), emergency source. Both sources are shown as deenergized, but switch is on normal throw

Lights Indicate Transfer Switch Position

FRANK E. REEVES
Director, Electrical Instructions
Baton Rouge, La.

Indicating lights can be added economically to an existing automatic transfer switch to show which of two sources is feeding emergency lights. Automatic transfer switches for such applications should be equipped with auxiliary contacts. In the installation in question, however, the switch was already installed, and it was not practicable to add auxiliary contacts.

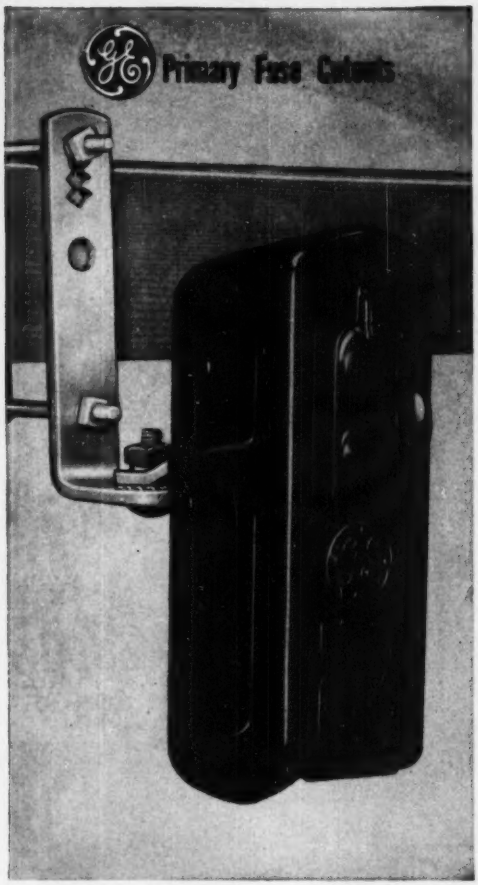
The switch was of the electrically-operated, mechanically-held type, and was equipped with contacts which disconnect the coil just before the operating mechanism reaches dead center of throw. Final movement of the switch to complete its throw is accomplished by inertia of a rotating weight.

Green and red pilot lights were connected as shown. Both lights are fed through the operating coil, the green light from the ac source, and the red from the dc source. Auxiliary contacts (OC), operated mechanically by the switch mechanism in the same manner as auxiliary contacts on circuit breakers, provide a positive indication of power contact position.

When both sources are alive, coil of supervisory relay (SR) is energized; its normally open contacts are closed and its normally closed contacts are open. Operating coil (OC) is not energized because its auxiliary contact (OC) is open under this condition. However, due to the low impedance of the operating coil, enough current will pass through it to cause the green light (G) to burn at essentially full brilliancy. The red light (R) will receive no voltage.

When the normal source fails, coil of supervisory relay will be de-energized causing transfer of its contacts. Operating coil will be energized from the battery and the load will be transferred to the battery. Transfer of OC contacts during the switching operation will kill the operating coil, but set up the circuit ready for restoration of the load to the normal ac source when it again becomes alive. Green light will be de-energized by the transfer of the OC contacts. Red light will be energized through operating coil.

Book publication rights reserved by author.



This cutout is liberally designed—has high dielectric strength, uses silver-plated contacts, provides full-range interruption of fault currents, and is conservatively rated as to interrupting capacity. All live parts are completely enclosed for maximum safety.

4 CUTOUTS IN ONE

by simply changing doors

AND THAT'S ONLY HALF THE STORY! By stocking only three interchangeable doors which fit both 5.2 and 7.8 kv, 50-ampere housings, you get the 4 operating functions illustrated below—a total of eight essential cutout combinations! Available also in 100-ampere ratings, this unique flexibility reduces inventory and simplifies stocks.

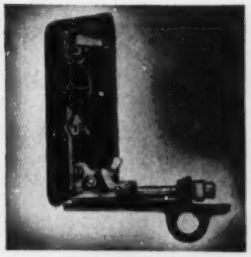
INDICATING OR DROPOUT WITH A TWIST OF THE WRIST! A small wire yoke, easily inserted or removed, determines whether the fuseholder door "kicks out" at the bottom for visual indication, or drops open—either way giving positive evidence of a blown fuse.

RECLOSING DOOR AVOIDS UNNECESSARY SERVICE TRIP! The two-element reclosing door restores service within one second after a temporary fault blows the first fuse link. By avoiding an extra service trip, the two-shot cutout pays for itself the first time it operates!

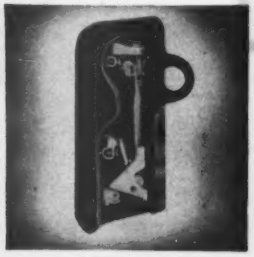
FLEXIBLE DISCONNECT BLADE CAN'T GET LOST! It's fastened to the door—can't be misplaced. This disconnect blade doubles the continuous current rating of the cutout. When the blade is disconnected and the door closed, the flexible cable extends downward to indicate that the circuit is open.

Only G.E. offers you this flexibility of cutout applications. For complete information contact your G-E sales representative, or write for Bulletin GEA-3448. *General Electric Co., Schenectady 5, New York.*

Indicating


Drop-out

Reclosing


Disconnect

GENERAL ELECTRIC

406-39

HERE'S THE NEW G-E 32-STEP REGULATOR

You get single-phase ML32 for same price as 8-step unit. And look at these features!

- **±10% regulation.** 20% range of regulation in thirty-two 5/8% steps.
- **Complete range of ratings** in the 2500-volt class (50 to 150 amps), the 5000-volt class (50 to 100 amps) and the 7620-volt class (25 to 100 amps).
- **New improved switching mechanism** has controlled tap-changing speed that gives maximum contact life.
- **Class I control accuracy**—the highest accuracy classification defined by industry standards.
- **New position indicator** is large magnetic-type, slanted downward for easy reading from ground.

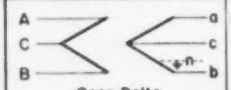
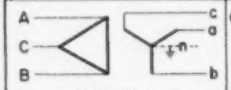
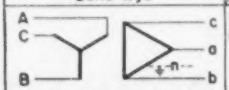
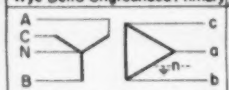
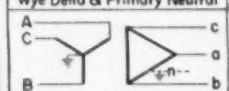
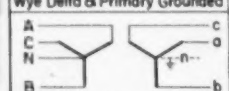
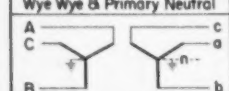
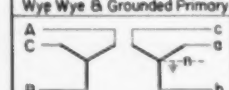
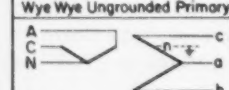
For more information on today's best regulator buy get in touch with your local General Electric Apparatus sales office. Or write General Electric Co., Sect., 404-89, Schenectady 5, N.Y.

GENERAL ELECTRIC

404-89

Three Phase Distribution Transformer Connections

Adapted from specifications of Consumers Public Power District, Lincoln, Nebraska

Primary / Secondary*	Regulation: 1-ph / 3-ph	Like Transformer impedance necessary: Phase shift	Best type of use	Limitations of connection
Delta Delta	Very good / Very good	Yes / 0°	Large 3-phase loads, with small to moderate single-phase lighting load. Lighting transformer carries about 66% of single-phase lighting plus 33% of 3-phase load.	Very good from standpoint of telephone interference. All units must have same voltage ratio and be connected on same regulating tap or high circulating currents may result.
 Open Delta	Poor / Poor	No / 0°	Large single-phase loads with small amounts of 3-phase load. Do not use for 3-phase motors above 15 hp. Place single-phase welders on power leg.	Inefficient use of transformer capacity. Only 86% of 3-phase capacity available. Each transformer carries 58% of power load. Place lighting transformer on leading phase.
 Delta Wye	Good / Very good	No / 30°	Three-phase secondary networks where light and power are taken from all phases, with lighting load balanced on three phases.	Primary faults may burn out motors without overcurrent protection on all phases. With units of unequal kva ratings, maximum safe output of bank is three times lowest rating. Disabled unit renders bank inoperative.
 Wye Delta Ungrounded Primary	Very good / Very good	No / 30°	Unbalanced 3-phase loads. Lighting transformer carries about 66% of single-phase lighting plus 33% of 3-phase load. Power units each carry about 33% of both lighting and power load.	Best wye-delta connection. Open primary may burn out motors without overcurrent protection on all phases. Disabled unit renders bank inoperative if primary neutral is not available.
 Wye Delta & Primary Neutral	Very good / Very good	No / 30°	Unbalanced 3-phase loads. Lighting transformer carries about 66% of single-phase lighting plus 33% of 3-phase load. Power units each carry about 33% of single-phase load plus 33% of 3-phase loads.	Very susceptible to transformer burn out on primary faults. Acts as balancing transformer for unbalanced primary, loading units and reducing available capacity or burning out.
 Wye Delta & Primary Grounded	Very good / Very good	No / 30°	Unbalanced 3-phase loads. Lighting transformer carries about 66% of single-phase lighting plus 33% of 3-phase load. Power units each carry about 33% of single-phase load plus 33% of 3-phase loads.	Very susceptible to transformer burn out on primary faults.
 Wye Wye & Primary Neutral	Good / Good	No / 0°	Three-phase secondary networks and isolated loads where large lighting load should be split on three phases.	Neutral must be solid and of low resistance. Some telephone interference from harmonics in generator wave.
 Wye Wye & Grounded Primary	Very poor / Good	Should be / 0°	Balanced 3-phase load.	Connection is extremely hazardous. May cause serious telephone interference and transformer failures.
 Wye Wye Ungrounded Primary	Very poor / Good	Should be / 0°	Balanced 3-phase load. Connection can be used if secondary lines are connected to wye-delta bank or zig-zag autotransformer.	This is the most hazardous transformer connection. May cause serious transformer failures and telephone interference.
 Open Wye Delta	Poor / Poor	No / 30°	Large single-phase loads with small 3-phase load. Do not use for 3-phase motors above 15 hp. Place single-phase welders on power leg. Neutral must have same capacity as phase conductors.	Poor voltage regulation and inefficient use of capacity. Only 86% of 3-phase capacity available. Each unit carries 58% of power load. Place lighting transformer on leading phase.

*All delta-connected secondaries have 240v line to line; all wye-connected secondaries have 208v line to line. Both types have 120v from line to neutral.

BLADE FEATURES

of DELTA-STAR'S *New*

"B-2K" Outdoor Disconnect SWITCH

23kv, 600 ampere "B-2K" Disconnect

This new "B-2K" has everything you could possibly ask for in an outdoor disconnect switch—*excellent thermal characteristics; high electrical conductivity; a far more rigid blade construction; constant high-pressure, long-lasting contacts; positive, easy-operating blade pryout and lock assembly* with large 3-inch hook ring.

BLADE CONSTRUCTION assures accurate contact alignment. The hard drawn tubular copper blade is split and flared at the hinge end which gives it great transverse stability when open. There is no possibility of contact misalignment. Switches mounted above circuit breakers, transformers or other equipment are closed with accuracy and precision, even when it is necessary for the operator to stand to the side of the switch.

A cast bronze insert is riveted inside the blade at the clip end to prevent distortion when slamming it closed. Operation is quick and easy in all types of weather. A slight pull on the hook ring is all that is necessary to break ice or corrosion accumulations.

"B-2K" switches are available in single and double throw for upright and inverted mountings in current ratings of 600 and 1200 amperes and in voltages up to 161 kv.

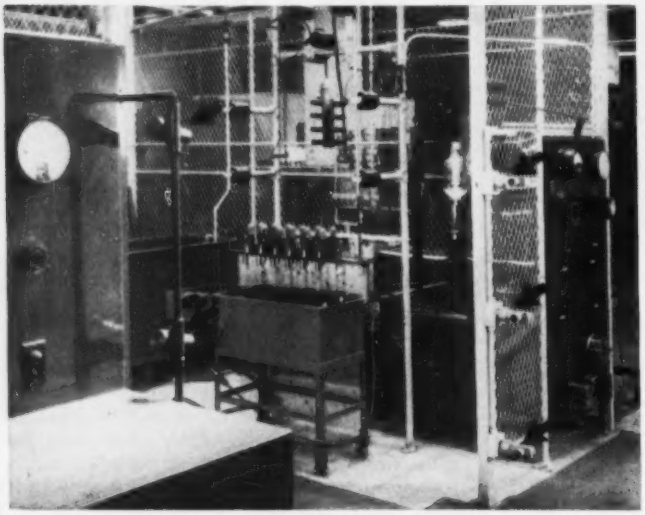
ASK FOR PUBLICATION 5104

WHEN YOU WANT THE BEST IN HIGH VOLTAGE SWITCHING EQUIPMENT SPECIFY DELTA-STAR!

DELTA-STAR ELECTRIC COMPANY
DIVISION OF H. K. PORTER COMPANY, INC.
2437 Fulton Street · Chicago 12, Illinois
DISTRICT OFFICES IN PRINCIPAL CITIES

Lights and Electric Eye Protect Cage

Red blinker lights and a photoelectric grounding circuit have achieved such a great degree of safety in a 40-kv dc glove-test cage built by Niagara Mohawk Power Corp that one operator can perform the tests without endangering himself. The safety precautions further protect workmen engaged in other work around the cage.



GLOVE-TESTING CAGE is made safe by photoelectric cells (arrows show five of six) which deenergize 40-kv dc bus when beam is broken. Blinker lights (not shown) face cage entrance and operate when bus is energized or set to be. Cage has warning signs on all sides

Blinker lights are in the same circuit with electrical interlocks for the high voltage bus controls. The lights are energized through a reset button which unlocks the electrical interlocks. Voltage cannot be applied to the high voltage bus until this reset button is pushed. This button, along with bus voltage controls and voltmeter, is located on a panel outside the cage. Blinker lights continue to operate after bus is energized.

The photoelectric circuit guards the entrance to the cage when the bus is energized. If the light beam across the entrance is broken, the high voltage bus is shorted to ground, a bell rings and the blinker lights go out. The electrical interlocks also lock out the bus voltage controls. When the cage was first completed, tests showed that a man entering the energized cage could not contact any portion of the high voltage bus before it was deenergized.

In addition to these two safety precautions, warning signs have been placed on all four sides of the wire screen surrounding the equipment.

Dirt Loading Machine Cuts Construction Time

DIRT BUCKET dumps automatically at the top of the elevator track. Homemade machine not only cuts size of construction crew required for the project but also speeds up process of getting material out of the excavation. As work progresses, extension legs may be added

Savings in cost, platform construction and manpower have been effected by a dirt loading machine used by crews of the Electric Power Board, Chattanooga, Tenn. The machine consists of a loading bucket which rides on an elevator track. It was devised by Supt. E. Kelley from an old pipe-die cutting motor and stand, a hot water tank and assorted pipe.

The loading bucket, cut from the end of a hot water tank, is 18 in. in diameter and 18 in. long. Two wheels on a frame on each side of the bucket carry it on the elevator track. The bucket loads 1/6 cu yd of dirt.

The elevator track is a ladder-like structure consisting of four 1-in. pipes, two of which guide the bucket wheels and two of which are bottom supporting rails. Guide rails are joined to the bottom rails by ½-in. rods welded between them. Lengths of 1-in. pipe are used to join opposite bottom rails together. They are welded to the bottom rails in a manner similar to

You can

SAVE MONEY

with this new

TRANSFORMER-LOSS COMPENSATOR

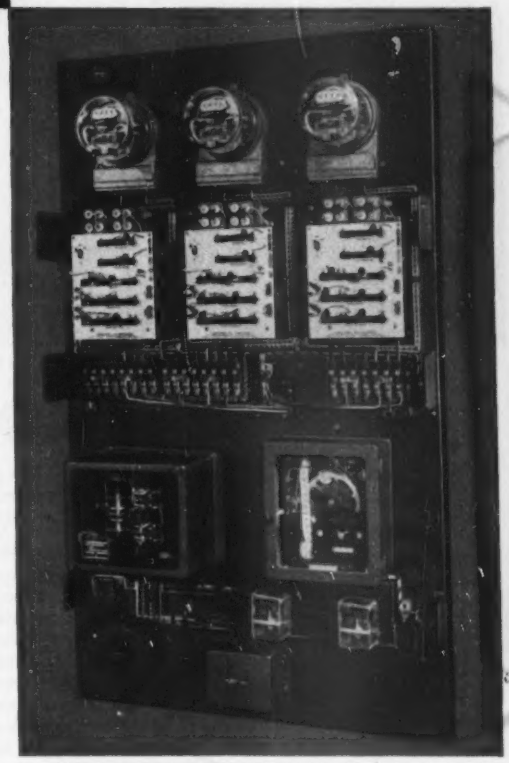
IMPORTANT savings are realized from the very moment you install the new TESCO transformer-loss compensator . . . as it provides an accurate means of measuring the energy and demands of high-voltage services at the low-voltage side of the transformers.

Simply, the compensator adds to the registration of the watthour meter an amount that is equal to the sum of the iron and copper losses of the transformer bank. It may be used with practically any type of watthour meter and . . . this is important . . . *no changes are made in the meter itself, either structurally or in adjustments!* It retains its integrity as a standard measuring unit.

TESCO developed the compensator for use on customers' installations where the contract provides for supplying and billing for energy and demand at distribution or transmission voltages.

The compensator is produced in two- and three-element types for use with two-element or three-element meters on any type of circuit . . . is connected into the 5-ampere secondary circuit of the meter current transformers . . . and will carry 100% overload continuously! The compensator is rated 120/240 volts for direct connection to the low voltage supply, or to the secondaries of the meter potential transformers.

FREE! *Detailed, informative 64-page booklet is yours for the asking! It explains fully the operation, installation, varied applications, of TESCO Transformer-Loss Compensators for Watthour and Varhour Meters! Contents further include Loss Calculations, Sample Calculations, Test Procedure, Unusual Conditions, etc.*



Here are TESCO transformer-loss compensators on a two-element 6.6 KV 18,750 KVA metering installation with three transformer banks. Metering is compensated to the 66 KV dual service supply. Compensator and panel covers removed.

TESCO

The EASTERN SPECIALTY COMPANY

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EVERSTICK ANCHORS...

EXTRA Holding Power

QUICKLY Installed

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● They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all others. Available two-way, three-way, four-way, and cone types. Write for facts.

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FEATURE
Exclusive Everstick nut housing. Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO.

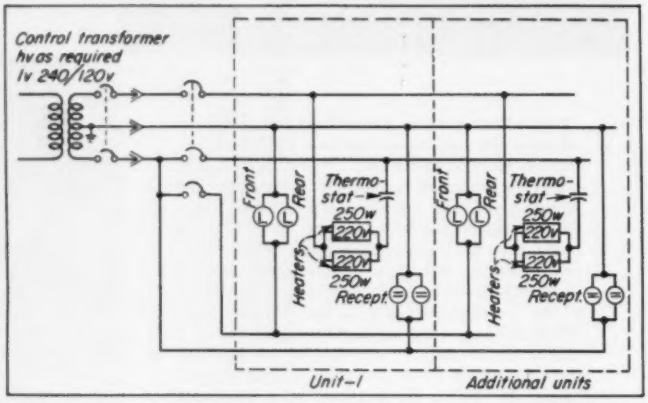
Manufacturer of "THE ANCHOR OF MERIT"

FAIRFIELD, IOWA

rungs on a ladder. The elevator track is comprised of a 12-ft and a 6-ft section, the shorter section being an extension for use when the excavation is deeper than 6 ft.

Pointed-rod inserts in the lower end of the longer section serve as connectors for the extension section.

The driving source for the bucket is a portable power pipe threading machine equipped with a ½-hp motor geared extremely low. This machine mounts on the bottom rails of the elevator track. A limit switch automatically cuts off the motor at the proper time for the bucket to complete its dumping operation. A small drum attached to the drive shaft accomodates the ¼-in. tiller rope used to lift the bucket.



SIMPLE AUTOMATIC CONTROLS are set to turn on 500-w heaters when temperature inside switchgear cubicle drops to 80F. Controls will turn off heaters when temperature rises

Prevent Condensation in Switchgear

H. V. NYE
Consulting Engineer
Switchgear Section, Allis Chalmers
Mfg Co
Milwaukee

An automatic heating control which prevents condensate from forming in switchgear housings during rapid changes of outdoor temperature and humidity has been developed. Except for unusual conditions, this system gives reasonable protection to outdoor installations. In the past, manually controlled space heaters were installed to keep the inside air warmer than the outside air. However, the new system offers decided advantages over manual control and is economical as well.

This new system utilizes space heaters that are equipped with a thermostatic control. The unit maintains inside temperatures considerably higher than outside temperatures, up to a cut off point of 90F. Above this point, heat is undesirable, as it adds to the heating of the switch, and may cause temperatures higher than those for which the switchgear was designed.

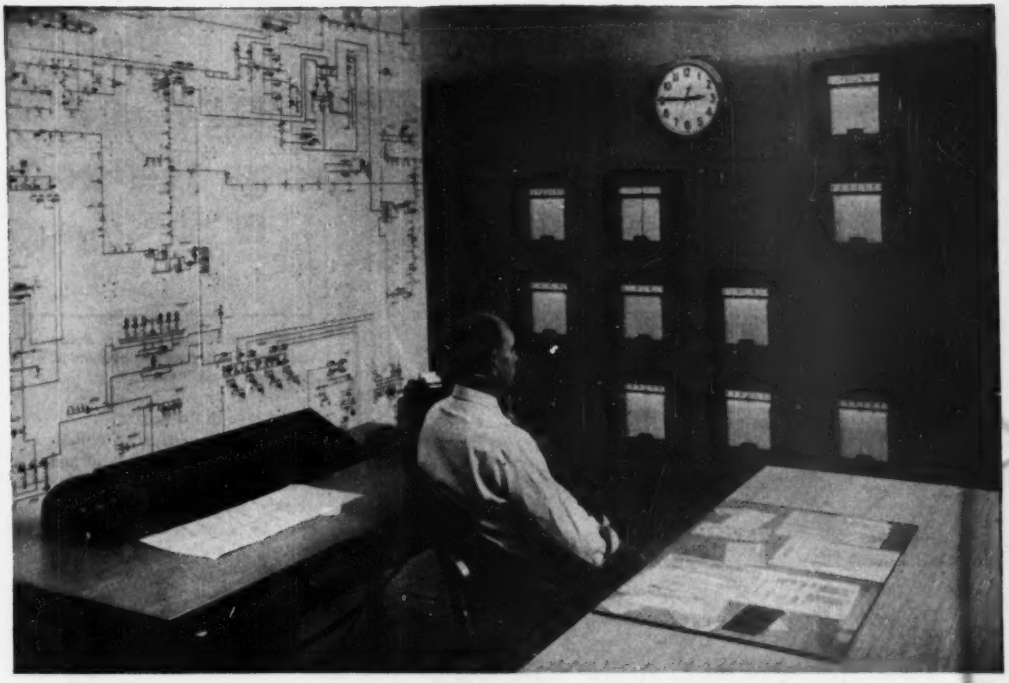
The capacity of heaters used is determined by the size of the switchgear housing, but an overall average for standard housings is about 500-w. The heaters will be in use at low temperatures but never at high temperatures.

The control system needs no attention and is safe and economical to operate. Independent control for each housing is available so that protection is independent of load distribution among units.

Spray Ash Hopper With Improved Nozzle

PAUL HUTSON
The Ohio Power Co
Philo, Ohio

An improved spray-nozzle head has been developed and applied to the retractable ash-hopper spray system used at the Philo plant. With the new head design, better deflection and diffusion of the water stream is obtained. Coverage can be adjusted to the size of the hopper by giving more or less curvature to the deflecting plate. Volume of water used can be adapted to the pressure by changing the size



HERE'S WHY **SPEEDOMAX** *INSTRUMENTS do a better load-telemetering job*

Today's growth of system load and system capacity places even greater premium on speed and accuracy of load dispatching. Quality of the dispatching job, however, depends to a considerable extent on the means used for telemetering load facts from all parts of the system to the system operator's office. Here are some of the reasons why major power systems have selected Speedomax Telemeters to do their data-gathering work:

DESIGN FEATURES

Response: Choice of impulse or continuous types, depending on speed required for the application.

Accuracy: Reproduction of measurements is so faithful that transmitter and receiver charts are practically identical.

Self Synchronizing: Transmitter and receiver automatically stay in step—can even operate from power sources at different frequencies.

Simplified Testing: Built-in checking facilities permit test and calibration of channel without meter tests.

OPERATIONAL FEATURES

Transmission Distance: Works with telephone, microwave or carrier channel, over any distance the channel can span.

Retransmitting and Totalizing: Speedomax can be supplied to retransmit, to integrate, to add up area generation, net interchange, etc.

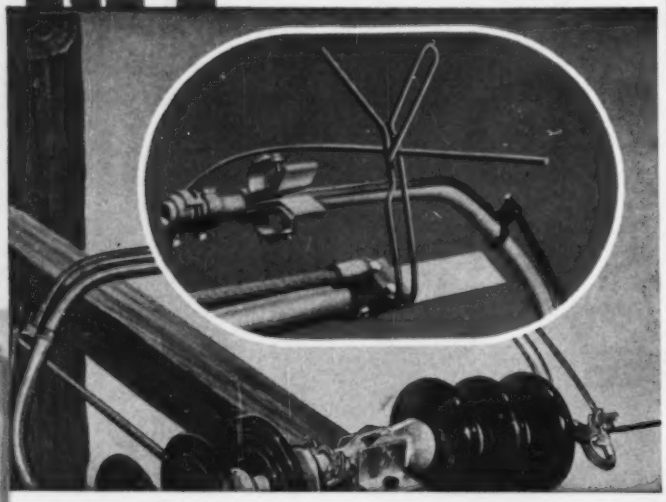
Automatic Control: Speedomax Telemeters work directly with L&N Load-Frequency Control, and are engineered as an integral part of system control.

For details, write to Leeds & Northrup Co., 4938 Stenton Ave., Philadelphia 44, Pa.

LEEDS NORTHRUP

Jrl. Ad ND46-58-461(4)

KPF POLE TOP SWITCHES



Drop 40 miles of 69 kv lines with KPF Quick-Break pole top switch

Operating engineers tell us KPF switches with Quick-Break attachment are the most outstanding air-break switch improvement in 25 years. Before development of this Quick-Break device, pole top switching of 69 kv circuits was limited to some 6 miles of line. Now, operating experience shows that 40 miles of 69 kv line can safely be dropped with this equipment.

The secret of the KPF Quick-Break is a heavy-duty cat's whisker which whips free in a split second as the switch is opened. This mechanism prevents establishment of an arc; thus critical arc length is no problem.

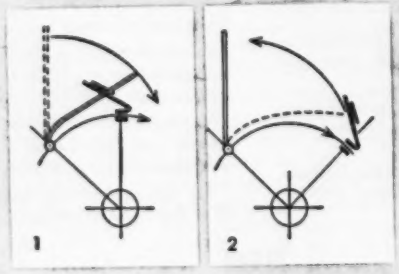
The KPF Quick-Break attachment is simply and ruggedly constructed for low cost, long life and all-weather dependability. It is available for all KPF switches rated 15 to 69 kv.

HERE'S HOW KPF QUICK-BREAK WORKS

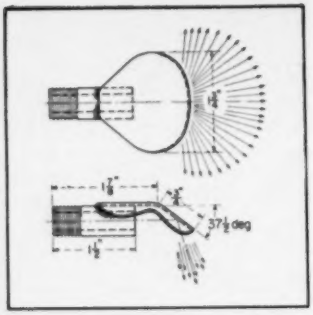
1. Spring rod winds to full tension as switch opens.

2. Rod springs clear, breaking contact at high speed.

Write for details of KPF Quick-Break attachment and low cost, long-lasting, easy-to-install KPF Switches.



KPF ELECTRIC COMPANY
1624 E. Alpine Avenue • Stockton, California

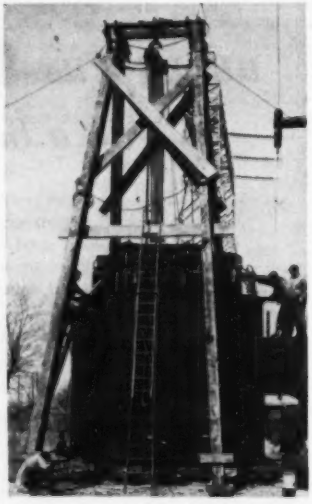


NOZZLE HEAD of improved design provides better deflection and diffusion of water spray used in ash hopper

of the hole in the nozzle.

The spray-nozzle head is patterned after the atomizer used to create a dense fog over vegetable stands. It is quickly and inexpensively made from No. 18 gage stainless steel sheet formed in a die and tack welded to half of 6x¼ in. extra strong nipple.

Electric Hoists Speed Field Inspection



Power Drives solved problem of inspecting 23-ton coil at Oklahoma Gas & Electric substation. Two chain pulley wheels on steel shafts and bearing blocks mounted on channel irons were driven electrically, eliminating need for two men working chain hoists with four men standing by. Time saved was slightly over 2 hr for each operation of raising or lowering the transformer coil.

Coolest spot on the line

O-B COOLINE CLAMPS eliminate power losses that are associated with overheating of transmission line hardware. Their non-ferrous alloy is not subject to hysteresis and eddy current action. Therefore, yearly loss of power and resultant overheating are eliminated.

Recovering these losses naturally means more saleable power available at the meter. When considered for a period of only a few years, saving of these losses will more than pay the entire cost of the hardware.

Investigate O-B Cooline hardware yourself. It fully pays out early in the life of the line and then goes on earning dividends.

Ohio Brass

MANSFIELD • OHIO

4219-H

INDUSTRIAL • APPLICATIONS

Good Lighting . . . Better Inspection . . . More Steel

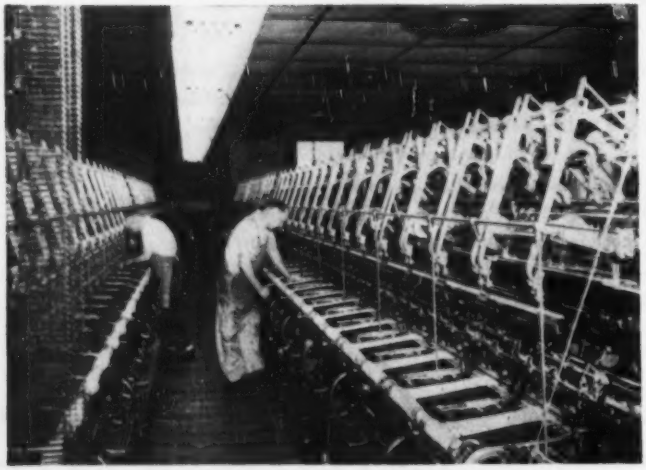
BETTER INSPECTION of defects in steel billets and slabs aided by 50 ft-c of combination 3000 w mercury vapor and 1000 w incandescent units helps produce more steel. By connecting units to 440v, 3 phase (through necessary auxiliaries) wiring expense was minimized

E. M. WENNER
Duquesne Light Co.
Pittsburgh, Pa.

Mercury vapor 3000 w units combined with 1000 w incandescent lights provide easier seeing conditions and better inspection in the scarfing area of the Jones & Laughlin Steel Corp., Pittsburgh, Pa. Any defects such as slivers, seams, cracks and tears are more quickly and efficiently removed from billets and slabs under the 50 ft-c intensity of light provided. Fewer units were required due to the high efficiency of the large lamps. This also results in less maintenance.

Wiring expense was minimized by connecting the lighting units to 440v, 3 phase system through the necessary auxiliaries. The incandescent lights provide color correction and a means of re-establishing lighting instantly in the event of an interruption of service in the lighting system. After power is applied to mercury vapor lamps, there is some delay in the production of light.

Air Conditioning Steps Up Hosiery Production



PRODUCTION EFFICIENCY is increased and rejects are reduced by air conditioning hosiery mill. Automatically controlled temperature and humidity improve employee morale

L. ALBERTSON
Application Engineer
Philadelphia Electric Co

Air conditioning raised hosiery production 15% during the first 7 mo it was installed at Ardmore Hosiery Mills, Andalusia, Pa. Machines require adjustments at less frequent intervals with controlled temperature and humidity. Hosiery is produced in uniform length because contraction and expansion of machine parts and knitting material are eliminated.

Air conditioning in departments where seaming and inspection operations are made, also prevents stuffy weather from causing let-ups in top production speed. Fewer rejects occur and employees have no tendency to take "days off," after working in a comfortably cooled atmosphere. Knitting has 83 F temperature and 43% humidity.

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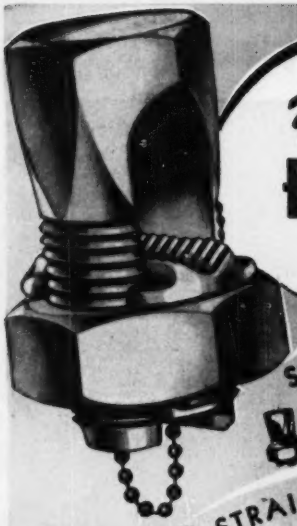
you need — in the



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STRAIGHT CONNECTORS

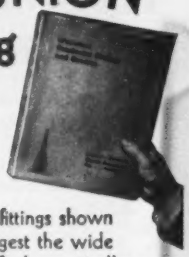
TEES

LUGS

GROUNDING CONNECTORS

and MANY MORE

PENN-UNION Catalog



The conductor fittings shown here can only suggest the wide variety. You'll find practically every good type, in a complete range of sizes.

New connectors are constantly being added - - so when you need a special fitting for an unusual service, tell us about it. Most likely we have exactly what you want.

Better design is a Penn-Union feature that you'll appreciate. For example, note the large gripping surfaces for wrenches, on the service connector shown in the upper left corner. When you use any Penn-Union fitting, you are sure that it is dependable - - mechanically and electrically.

Preferred by Leading Users, who have found that the "Penn-Union" mark on a connector is their best guarantee of unfailing service.

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PENN-UNION ELECTRIC CORP.
ERIE, PA.

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THE *Complete* LINE OF CONDUCTOR FITTINGS

PENN-UNION

Heat Lamp Banks Dry Soggy Football Fields

As a result of a new use of heat lamps, wet grounds now can be less of a problem at football fields, baseball diamonds, and scenes of other athletic events. Several colleges and universities plan to use them during the football season if the weather is uncooperative.

The intense infrared radiation from heat lamps presents a new opportunity for emergency drying of water-soaked patches of turf, according to Robert T. Dorsey, G. E.'s sportslighting specialist.

The first major effort to dry out an athletic field reportedly took place at the University of California's Memorial Stadium just before the Stanford-California game last November 25. It had rained for ten consecutive days in California, and the mud was ankle-deep in many places.

After all other efforts to dry the field had failed, the banks of infrared heat lamps were tried. Two banks of lamps, each consisting of sixteen 500-w lamps in industrial-type units, were used. Drying areas of 30 sq ft at a time, the units were moved every 40 min throughout the night before the game. By game time the field was in greatly improved playing condition.

The success of this operation indicates the desirability of portable banks of heat lamps as part of the standard equipment of athletic field groundkeepers. Rather than try to dry out an entire field, it was found to be more practicable to confine the drying process to several of the worst mud holes on the football field or baseball diamond infield. Similar banks of infrared lamps might be used to advantage for the drying of tennis courts, race tracks, and other outdoor areas.

In addition to their use in the drying of athletic fields, banks of heat lamps can be used during cold weather in keeping players on the bench warm and comfortable.

General Electric Co

WET GROUNDS on football, baseball and other athletic fields can be dried with portable infrared lamp banks. Picture shows one of the two lamp banks used for drying soggy turf at University of California stadium

INDUSTRIAL BRIEFS

Bacteria Control of table syrup is accomplished by bactericidal lamps at the Syrup Division of the Anheuser Busch Co. in New Orleans. Airborne bacteria are killed in the empty cans before they are filled with syrup. A continuous line of five 30-w Bactericidal lamps are installed in reflectors mounted 3 in. above the tops of the empty cans on conveyor belt. Control of bacteria in voids between syrup level and tops of cans has proven so successful that an additional installation is being made over newly extended conveyor line. J. M. Gensburger, Industrial Engineering & Utilization Dept, New Orleans Public Service Inc.

Molasses Heating with electric heating elements completely eliminated a fuel-fired boiler at the Sunshine Feed Mill, Nashville, Tenn., along with its attendant labor and fuel problems and fire hazards. It provides automatic control, complete safety, and assurance against overheating. Five electric heating elements totaling 20 kw heat city water which is circulated through pipe coils in the 4-ft diam by 4-ft high molasses tank previously used for the fuel-fired steam heating. Molasses flows thru tank at 3 gpm and is heated to 80F. Hugh S. Evans, Jr, Power Sales Dept., Nashville Electric Service.

TV Studio Lighting with fluorescent lamps improves video signal and provides better studio working conditions for performers at WBAL-TV studio, Baltimore, Md. Lighting and air conditioning loads were reduced. Warmtone 75 w, 8 ft slimline lamps were selected for adequate color quality and lighting levels. Studies showed that 200 lm per sq ft was adequate for 5655 camera pickup tube stopped down to F 5.6. Installation was engineered with cooperation of Sylvania Electric Products Inc. to determine most desirable color light quality for matching response of human eye and TV camera pickup.

Conveyor Belt Heating by two 275 w infrared lamps eliminates clay sticking and improves accuracy of automatic cutting machine at Fairfield Brick Co., Zoarville, Ohio. Errors in cutting are fewer and scrap returned to brick machine is reduced. High production is assured. Clay column travel is measured by means of a circular wheel riding on the belt which conveys the clay column thru the cutter. G. W. Craiglow, Industrial Power Engineer, The Ohio Power Co., Canton, Ohio.

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POWER DISTRIBUTION

SQUARE D FEED-IN DUCT

is the most efficient way to transmit large amounts of power. It provides the lowest known voltage drop—only 1.8 volts per 1000 amperes per 100 feet.

Exclusive design requires no ventilation—permits a totally enclosed, compact, dust-excluding enclosure. Rigid construction provides high resistance to heavy electrical stresses.

SQUARE D PLUG-IN DUCT

provides flexible power distribution for branch circuits. Machinery can be rearranged quickly at minimum cost. Plug-in units can be attached at frequent intervals along the length of the duct, providing power where it's needed, when it's needed.

BUSWAY FEATURES PROVE DESIGN LEADERSHIP

NEW JOINT DESIGN. Feed-in Duct joint design saves installation time and reduces maintenance cost. Duct ends are identical—unnecessary to select mating ends before positioning or hanging duct sections. Outward-facing, pre-installed bolts permit rapid assembly and easy maintenance.

ROUND BUS BARS for Plug-in Duct provide greater mechanical strength and resistance to short-circuit stresses. Circuit breaker or fusible type plug-in units are easily installed at 2-foot intervals along both sides of the duct. Plug-in stabs grip the round bus bars with exceptionally high pressure.

FLEXIBLE CONNECTORS of laminated copper join bus bars between sections—permit proper alignment, insure tight joints and provide for expansion and contraction at Plug-in duct joints. All bolt heads face outward for greater accessibility.

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You know it's RIGHT when you specify CHANCE

Chance Anchors

meet every guying need

Anchoring costs represent only a small part of the cost of line construction . . . but a very important part. It can mean the difference between straight, sturdy lines that stand up under storm and extra load conditions or lines that sag or collapse under strain.

. . . So it pays to select the anchor best suited to the soil and guying condition. You can do this with the Chance line. Whether soil is sandy, clay, rocky, loam, swamp or solid rock; whether guying space is limited or unlimited; whether the line is light distribution or heavy transmission, there's a Chance Anchor that will do the job *just as it should be done.*

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SWAMP SCREW | POLE KEY | NEVER-CREEP | ROCK | STEEL CONE | STEEL SCREW

Chance Line Construction Tools...

help you build better lines . . . save labor

Anchoring efficiency depends a lot on how your anchors are installed. Hole sizes need to be exact for greatest holding power. The adjustable auger helps you bore them right. Proper expanding requires the right kind of expanding bar. Chance Line Construction Tools help crews do better anchoring and simplify pole setting operations. Consult your Chance Catalog. Order from your regular supplier.

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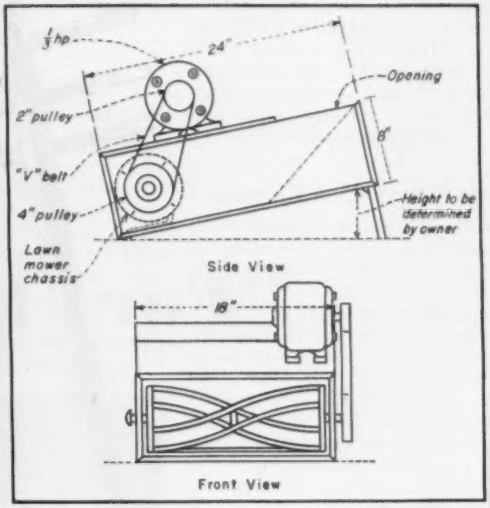

HOME MADE CUTTER prepares vegetables for stock feed

Vegetable Feed Cutter Saves Labor

R. T. JONES
Farm Service Manager
Pennsylvania Power & Light Co

Vegetables make good stock feed—beets, pumpkins, government-subsidized potatoes—but animals may choke on them if they are not cut up. But it is pretty expensive feed if the cutting has to be done manually; labor cost much too high. Clem Miller, a farmer in the service territory of the Pennsylvania Power & Light Co, tried several devices, including a hammer mill, for the preparation of such feeds, but results were not satisfactory.

He and his son, Lee, made the machine illustrated. They built it out of an old lawn mower parts. It works perfectly, and fast, making vegetables a really economical feed.

The Lady Chooses a Dishwasher

MAKING HER SELECTION in McCall's Test Rooms, Mrs. Homer Evans of Villanova, Pa., picked a dishwasher as the appliance she wanted most. Her husband took first place in a prize contest of McCall's Magazine

Let's Look At The "10,000 Kwhr Home"

Whether it's $108 billion or $54 billion, it's still Big with a capital "B". That's how Will T. Clark, residential sales manager, Cleveland Electric Illuminating Co, presented the appliance market potential of the "10,000 kwhr home" at the recent conference of the International Association of Electrical Leagues at New Orleans.

At the end of 1950 there were 39,000,044 residential and farm meters in the United States. Any one of these customers who buys the equipment necessary to make him a 10,000-kwhr user will spend at 1950 prices $2,787.50. That is a lot of money. This means that if we sell to every residential and farm customer in the United States the equipment necessary to make each of them a 10,000 kwhr user, we are talking about a volume

"For the Record"
PENTA * has a superior performance record of 15 years of protecting wood from termites and rot.
PENTA is an approved wood preservative and is a standard of the American Wood Preservers Association.
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of over $108 billion. That is big business in anybody's league and warrants big thinking all the way down the line from manufacturer to retailer.

We may never sell all of these customers enough equipment to make them 10,000 kwhr users. But we should at least sell 50% of them. So divide our potential of $108 billion in half and we still have a $54 billion business.

It may take us 20 years to reach this objective. That is a $2½ billion annual volume from new appliances alone. Once we reach our 10,000 kwhr goal for half of our customers, new and replacement sales can easily amount to $7½ billion per year.

These estimates do not include anything for the equipment that will go into new homes during this selling period. Neither does it include the cost for electrical energy.

Blankets Go South

Production of General Electric automatic blankets will be transferred to Asheboro, N. C., early this year. The company took over a 132,000-sq ft factory that was formerly occupied by the National Chair Mfg Co. Upwards of 300 persons will be employed in the new plant.

To Up the Low User

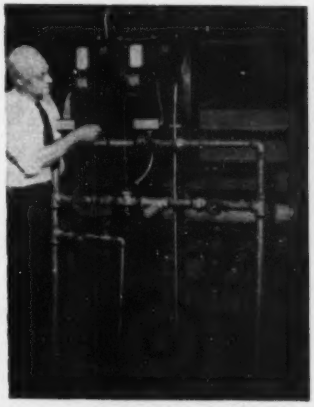
"Operation Power" a drive aimed at low-use customers of Florida Power Corp, was launched at the utility's recent operations and sales conference. Over 150 division and district managers, engineers, and commercial and residential sales representatives of FPC and its subsidiary, Georgia Power & Light Co, attended the three-day conference.

In explaining "Operation Power" C. W. Ailstock, director of residential development told the group that it was a drive to educate low-use customers on the benefits of complete electrical living.

"Many low-use customers are financially able to afford additional appliances or lighting equipment. They just do not know what electric service will do for them. So we must SEE 'EM . . . . . TELL 'EM . . . . . and SELL 'EM," Ailstock said. "Out of our 150,000 customers in the Florida-Georgia system, there are 26,000 using less than 50 kwhr per month. If their consumption is increased only 5 kwhr, or 25¢, it would mean $78,000 in additional revenue, and at practically no expense for line work and transformers."

Control Makes Sure Flower Bulb Pests Die

Daffodils grown as a crop by many farmers in the Puyallup Valley of Western Washington spring from bulbs which are subject to wire worms, nematodes, bulb scale mites and the bulb fly. All these pests can be killed by "cooking" the bulbs for three hours in a formaldehyde solution but the temperature must be held exactly at 110 deg. At 109 deg, the treatment is ineffectual; at 111 deg, the bulb is



ACCURATE to one fifth of a degree, special thermostats and solenoid valve hold bulb cooking solution at exact temperature

damaged. Puget Sound Power & Light Co solved the problem by using a special thermostat built to its specifications and accurate to one fifth of a degree, plus a system of controls that removes manual operation and guesswork. A solenoid valve automatically injects steam when the thermostat calls for it while a propeller circulates the water uniformly. Should the temperature vary one degree, an alarm sounds. Electric hoists lower and raise the stack of crates into the cooking tank, which holds ten tons of bulbs in 400 50-lb flats.

Aluminum Lamp Bases

The familiar yellow brass lamp bulb base is on its way to extinction in the view of the General Electric Lamp Division. This opinion was expressed in GE's recent announcement that it is now using aluminum bases in a large part of its lamp production. The first aim of the change was conservation of copper and zinc, but the merits of aluminum in this use, once the problems it presented were solved, will probably prevent return to brass.

Chicago TV, Over Million

Chicago has now passed the one million mark in number of television sets installed and in use, according to the Electric Association of the city. A survey to keep track of television sales in the 50-mile metropolitan area was commenced in 1948. In that year there were only 11,512 sets. By January, 1949, the number had increased to 89,156. The period of greatest growth was from 353,895 sets in January, 1950 to 815,471 sets in January, 1951. Since then the number of sets has risen steadily, but somewhat less spectacularly, to today's present figure of over a million.

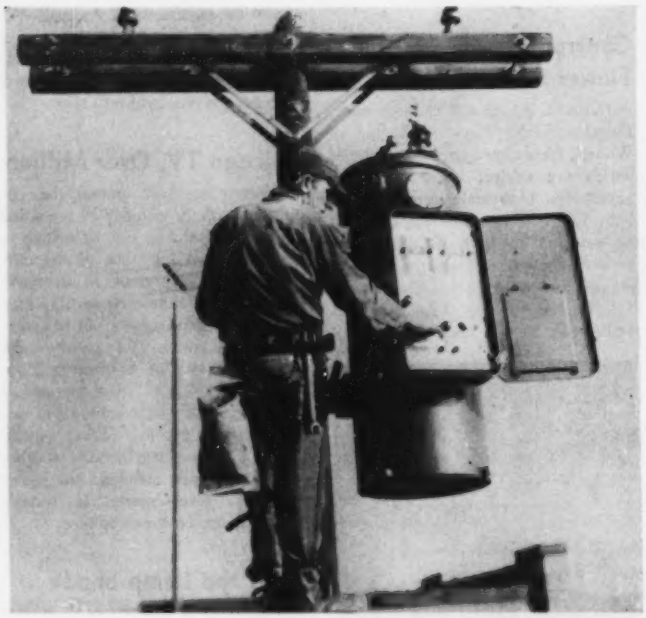
Grips the Lamp Shade

Claimed as a new concept in torchere lamp shades the "Vise-Grip" shade recently announced by Corning Glass Works features a tough, lightweight steel neck which makes the shade an integral part of the lamp itself. The lamp can be inverted and the grip of the steel springs in the neck will hold the shade in place. The steel neck also permits use of rugged pressed glass without excessive weight, which means less edge chipping and lower handling losses. The shade and steel neck are mechanically assembled in one piece at the factory.

Frozen Moose Meat

The salesman who sells refrigerators to Eskimos is a piker compared to H. A. Faroe, proprietor of the Northern Supply Co of Anchorage, Alaska. He sells food freezers, and lots of them, in a place where winter temperatures drop to 60 degrees below zero. Now on a combined business and pleasure trip, Mr. Faroe told General Electric officials in Bridgeport that he had sold six of the company's 11-cu ft freezers just a day or two before his departure. They are in big demand for the storage of moose meat.

NEW EQUIPMENT



Single-Phase 32-Step Voltage Regulator

A new single-phase, 32-step voltage regulator, designated the ML32 now supersedes the General Electric eight-step ML8. Regulator offers 10% raise and 10% lower regulation in 32, five-eighth percent steps.

The ML32 is available in voltage classes of 2500, 5000, and 7620 volts, with insulation levels designed for corresponding "Y" voltages.

A modified, rapid switching process incorporated in the regulator reportedly gives it maximum contact life.

Controls on this new regulator are designed to meet ASA Class I accuracy standards, and are assembled on a new, neatly arranged control panel, essentially the same as those used on large power transformers with load ratio control. A new magnetic position indicator provides easy reading from the ground.

General Electric Co, Schenectady 5, N. Y.

Protective Headgear

Consumers Power Co, Jackson, Mich. is now using laminated plastic protective hats for pole-top, surface, and underground line crews.

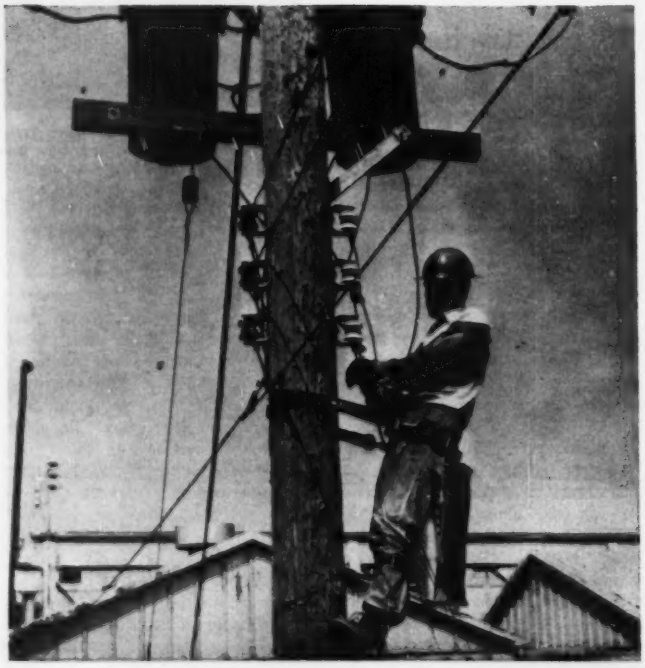
Hat is stated to have high insulation properties which provides protection in case of accidental contact with high voltage conductors. High mechanical strength is protection against falling objects.

The hat is designed to withstand severe impact, and a webbing cradle is built in to distribute the force of the impact over a large area, thus offering additional protection to the wearers head and neck. The smoothly rounded crown causes falling objects to glance off. The hats are light in weight and are easily adjusted to various head sizes. For winter wear, a warm cloth liner can be quickly inserted in the hat.

Company's safety hat program, started about a year ago, has been widely accepted by line crews. Experience has proven its worth.

Mine Safety Appliances Co, Pittsburgh 8, Pa.

(*Continued on page* 132)



No. 4320 Wide Base Clamp Pin U-Strap Type
No. 24320 Wide Base Clamp Pin Carriage Bolt Type
No. 4309 Cross Arm Corner Pin Angle Type
HUBBARD
HOT GALVANIZED
Right -on the LINE!

whether it's straight line or corner construction . . . it calls for HUBBARD INSULATOR PINS

Hubbard Wide Base Clamp Pins, Nos. 24320 and 4320 for angle or corner construction, are forged from new hot-rolled open-hearth steel. The broad bases of these pins present a large area to the arm, reducing "burning" and cutting into the wood to a minimum. The four lugs prevent the pin from turning on the arm. They are available in Carriage Bolt and U-Strap types as illustrated. Carriage Bolts and Plate are included with the No. 24320 style.

Hubbard Angle Type Cross Arm Corner Pins, No. 4309 style, are made from certified malleable iron for use on 4 by 5-inch cross arms. The back of the pin (the portion farthest from the bolt) is placed to the inside of the angle of the line, providing a leverage which offers maximum resistance to corner loading. They come with 1 and 1⅜-inch lead threads and for 1⅜-inch thimbles. Mounting Bolt, ⅝ by 6-inch, with washer, nut and lock nut is included.

HUBBARD AND COMPANY
ESTABLISHED 1843
PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA
"Hang the load on Hubbard Hardware!"

WHEN IS A ROAD *MORE* THAN A ROAD?

The new and revolutionary New Jersey Turnpike, shooting from the top to the bottom of New Jersey, is *more* than a road—it is one of the safest, most modern super highways ever built. In addition, the New Jersey Turnpike is a vital link in our defense strategy providing a non-stop avenue for the shipment of defense material.

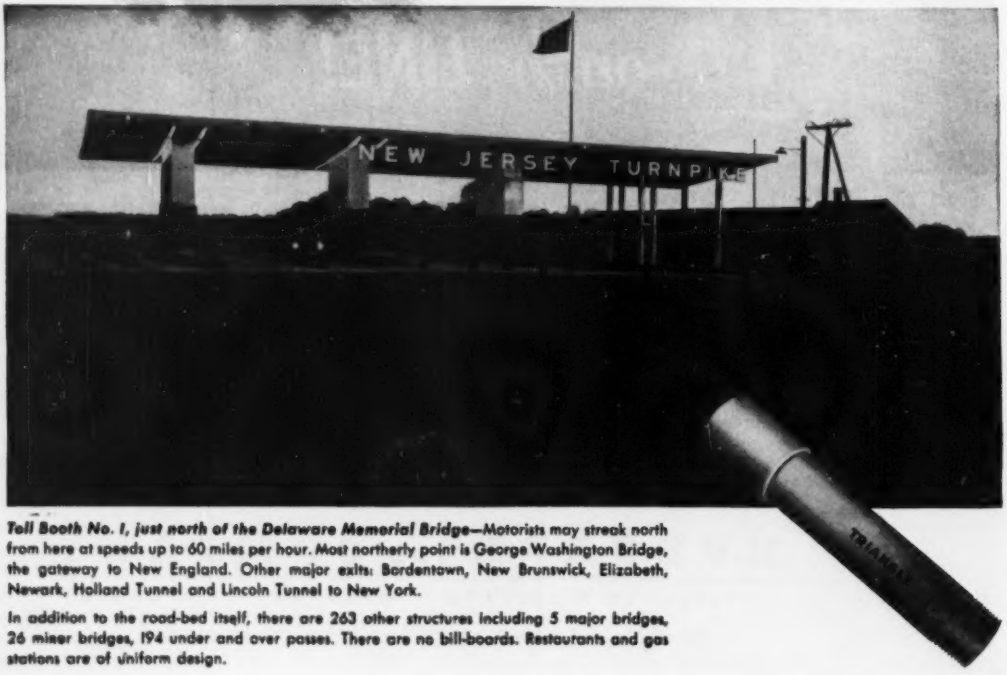
It is more than a road in another sense too! Those who built it in record time had more to think about than just laying cement and macadam. Involved also were seventeen modern toll booths, fifteen restaurants and gas stations, five radio buildings, six maintenance buildings and five auxilliary buildings.

For such a highway, the specifications were rigid! The electrical raceway, for instance, had to be of the highest quality—and it had to be delivered *on time*.

Triangle, realizing the importance of the project, rolled up its sleeves. One electrical contractor said, "If it hadn't been for Triangle deliveries, we never could have completed our job on time. They broke their backs to get the stuff to us."

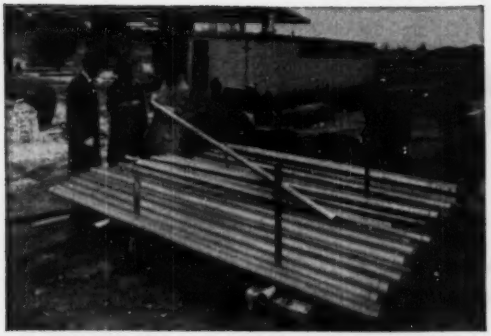
That pretty well typifies Triangle. If it can be done, they'll do it.

Chances are, you don't build roads. But if you have anything to do with the selection or installation of conduit in anything from bungalows to Atom Bomb plants, *it will pay you to specify Triangle*. It is hot-dipped galvanized and non-flaking. Of course, it conforms to Federal Specification. For top quality you can't do better.



Toll Booth No. 1, just north of the Delaware Memorial Bridge—Motorists may streak north from here at speeds up to 60 miles per hour. Most northerly point is George Washington Bridge, the gateway to New England. Other major exits: Bordentown, New Brunswick, Elizabeth, Newark, Holland Tunnel and Lincoln Tunnel to New York.

In addition to the road-bed itself, there are 263 other structures including 5 major bridges, 26 minor bridges, 194 under and over passes. There are no bill-boards. Restaurants and gas stations are of uniform design.



▲ ***A TRIANGLE EXTRA, the electrical contractors liked.*** George E. Scholes, right, Vice-President, Emerson-Garden Electric Co., New York and Elizabeth, N. J., examines one of the end caps which protects the threads of each piece of Triangle Conduit during shipment and delivery to the job. "Very worth while," Mr. Scholes said about the caps. "Protecting the threads like that saves us from cutting and re-threading if the original threads get banged up." With him is Joseph A. Korn, Project Supervisor (Electrical) and Emil Fackler, Triangle representative. Major part of electrical work was joint project of Emerson-Garden Electric Co. and Lightning Electric Service Co., Newark, N. J.

Toll booth in background is one of seventeen. Each needed intricate raceways to help operate its fool-proof system of recording passage of each car or truck.

The restaurant's cash register will go here. This picture was taken as if looking through the front door into one of the ultra-modern restaurants. Above the conduit in the foreground will be the foyer and the cash register. To the right will be the main dining room and to the left, a long ice cream and quick-lunch counter. The greatest percentage of the conduit used on the New Jersey Turnpike was Triangle's hot-dipped galvanized conduit. It was easy to work with. **In over one thousand 90° bends on two inch conduit, for instance, there was not a single piece that flattened or failed in any way.**

▲ ***Triangle Conduit for one of the restaurants.*** Over 120,000 feet of Triangle Conduit was used underground and in the various buildings along the route. In this picture, lengths of four inch conduit are put in place preparatory to pulling in cable and laying the transformer mat.

Each length of this conduit stretches underground and under the highway where it meets local utility lines. There are seventeen of these combination restaurants and gas stations, each of which utilizes Triangle Conduit.

OVER 99% OF THE CONDUIT USED IN CONNECTION WITH THE NEW JERSEY TURNPIKE was TRIANGLE hot-dipped galvanized!

THE TRADE MARK OF TOP QUALITY!

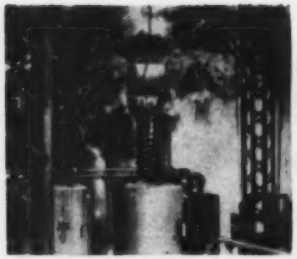
TRIANGLE

IT MUST BE RIGHT

CONDUIT & CABLE CO., INC.

NEW BRUNSWICK, NEW JERSEY

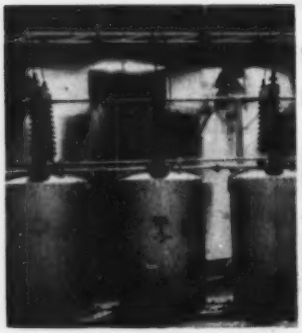
Glazon • Building Wire • Rate Wire • Armored Cable • Glazon Non Metallic Sheathed Cable • Service Entrance Service Drop Varnished Cambric Braided or Leaded Neoprene Trench Power and Parkway Cable • Rigid Conduit Hot Dipped Galvanized • Electric Metallic Tube Wall Conduit • Flexible Steel Conduit



PROTECTING

flammable, oil-filled

TRANSFORMERS



with time-tested, rapid extinguishing

GRINNELL MULSIFYRE

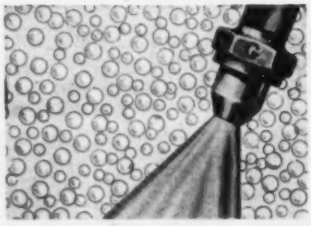
In case after case, where Grinnell MULSIFYRE has been on guard, hazardous oil fires have been effectively controlled — damage limited. For example . . .

● On August 2, 1944, a fault occurred on the 26 KV ring bus at a substation of the Public Service Electric & Gas Co., Harrison, New Jersey. Following the tripout, the operator noticed the end bay, where the transformer was located, to be ablaze. He immediately activated the electrical control operating the Grinnell MULSIFYRE System, deluging the transformer banks with water spray and extinguishing the fire.

● At a substation of the Omaha Publice Power District, Omaha, Nebraska, two 25-year-old three phase 6250 KVA 13.2-2.3 KV water-cooled indoor type transformers were protected by a MULSIFYRE System automatically actuated by Quartzoid Pilot Sprinklers. On August 30, 1944 a minor explosion occurred, setting the transformer afire. The Grinnell MULSIFYRE System went into operation immediately, and there was no fire damage.

● In 1948, a lightly built wooden sawing shed was erected by the Singer Manufacturing Company, Bridgeport, Connecticut, adjacent to a bank of three 500 KVA transformers. A fire started in the shed, apparently when a carelessly discarded cigarette or match ignited sawdust, and quickly burned through the roof. The MULSIFYRE System operated over the exposed transformers, preventing damage to them.

Stop future trouble and expense. Get complete facts *now* on reliable Grinnell emulsion-forming spray systems. Write Grinnell Company, Inc., Providence, R. I. Branch offices in principal cities.



GRINNELL *Mulsifyre*

EMULSION-EXTINGUISHMENT OF OIL FIRES

Expanding Anchor

Line Material has redesigned its expanding anchor to offer several improvements.

Holding power has been increased by larger sliding plates which have an expanded area 10% to 15% greater than the old design.

Tamping to the expanded position has been made easier by a new hinge arrangement at the point where spreader arm attaches to sliding plate. Spreader arm of anchor is heavier and stronger.

Line Material Co, Milwaukee 1, Wis.

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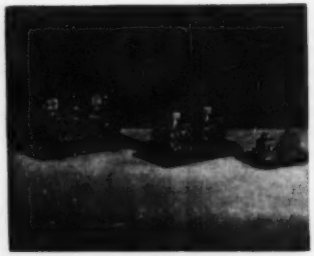


Ammeter Shunts

New shunts, all 50 millivolts, cover the range from 30 amps to 1200 amps. Terminals are of ample size with large flat surfaces for heat dissipation.

Shunts are mounted on bakelite blocks for insulation to 1500 volts. Shunt leaf material is manganim.

Assembly Products Inc, Chagrin Falls, Ohio

•

Photocopier

The new Auto-Stat enables anyone to produce clear, black and white photo-exact copies almost instantly. No developing is required.

Unit reportedly occupies no more space than a typewriter, and approximately 100 Auto-Stat copies can be made in an hour.

Machine measures 21-in. long x 8-in. wide x 5-in. high and operates with an ac motor. Dc motor drive available at slight extra cost.

The American Photocopy Equipment Co, 2849 No Clark St, Chicago 14, Ill.

•

Linemen's Climbers

The redesigned linemen's climbers provide added safety, greater comfort and longer service.

Shanks and gaffs are stated to be provided with uniform stress distribution by use of special heat treatment. Gaffs are surface hardened by Pack-Carburization method.

Climbers are examined by "black light" after immersion in light oil containing fluorescent-dyed ferrous particles.

Mine Safety Appliances Co, Pittsburgh 8, Pa.

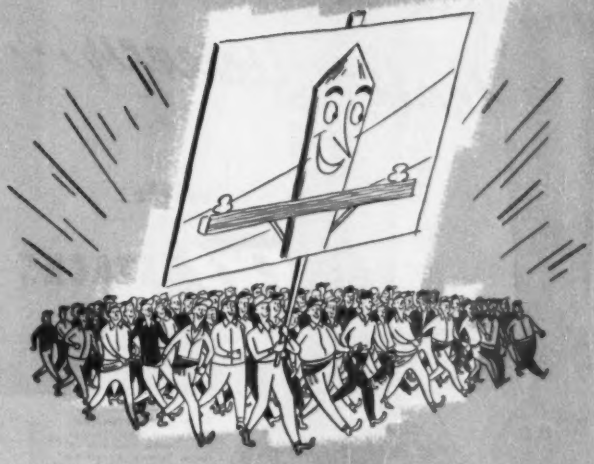
•

Elevated Runway Light

A new medium intensity runway light (Type LD) for use as day and night markers of non-instrument runways, landing strips and taxiways of all classes of airports is now available.

Mounting assemblies are of three

at the poles . . .



linemen vote for clean, certain Penta protection

When linemen go to the poles, they cast a rousing vote for PENTA. They know from their own experience that PENTA-treated poles are clean . . . easy on their clothes and body. They also know these poles are sound and safe . . . free from shell rot, top rot, ground line decay and insect damage.

Management votes for PENTA because they can absolutely depend on it to give poles long life and minimum maintenance. That's because PENTAchlorophenol is a powerful, stable and uniform wood preservative—gives measured and positive protection. It's always the same! Penetrates deeply and won't evaporate or wash away. Doesn't affect conductivity, creates no special problems.

Specify PENTA treatment for safeguarding your poles, cross-arms and other wood construction. It costs no more than other types of wood preservation. Write us for complete facts and the names of companies supplying PENTA-treated forest products.

CHAPMAN CHEMICAL COMPANY

Dermon Building, Memphis 3, Tenn.

333 N. Michigan Ave., Chicago 1, Ill.

CHAPMAN

Penta Preservative

It's Clean! It's Certain!

Conforming to A. W. P. A. Specifications P8-49 and P9-49

Single or double fan installations with automatic controls. Double operates on single furnace, or serves two. On single furnace either fan can operate up to 70 percent capacity; other fan then cuts in automatically.

TYPE 1 TYPE 1A

TYPE 2

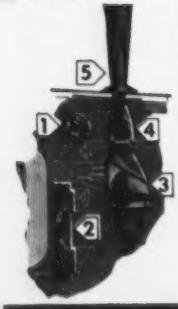
TYPE 2A

TYPE 3

You eliminate fluctuations or losses in draft efficiency by the use of Prat-Daniel Stacks. P-D Fan Stacks coordinate the relationship of fans, breeching and stacks to provide and maintain maximum efficiency.

Thousands of P-D Fan Stacks in long operation have proved their superior reliability over induced-draft fans and stacks purchased separately. Easily applied to any installation, they provide highly efficient draft for the load conditions of your power plant.

Our project engineers provide expert assistance on any problems of draft production and control. Call them on current problems or planned installations. Write for Catalog No. 200.



UNIT RESPONSIBILITY

Prat-Daniel, through its sales and project engineers, The Thermix Corp., offer a complete complement for handling the air gas stream shown at left; 1. Forced Draft Fans, 2. Air Pre-heaters, 3. Tubular Dust Collectors, 4. Induced Draft Fans and 5. Fan Stacks. This unit responsibility, by a well-known firm, relieves the engineer of the responsibility for one of the most important functions in a steam generating plant.

Sales and Project Engineers

THE THERMIX CORPORATION
GREENWICH, CONN.

Canadian Affiliates: T. C. CHOWN, LTD.
1440 St. Catherine St., W., Montreal 25, Quebec
50 Abell St., Toronto 3, Ontario

Designers and Manufacturers

PRAT-DANIEL CORPORATION
SOUTH NORWALK, CONN.

types, base mounted, column mounted for separate burial transformer, and column mounted for integral mounting transformer.

Feature is two V-notches which permit daytime alignment of fixture. Light uses 30 or 45-w lamp either from a series or multiple 600-v circuit or a 3000-v series circuit.

Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

•

Atomic Battery

The Ohmart Corporation of Cincinnati, has announced the discovery of an entirely new process of generating electrical current—directly from radioactivity—and the adaption of this phenomenon to a new line of nuclear radiation measuring instruments.

Although this phenomenon has reportedly produced enough current to run a small "gnat power" motor, the manufacturer feels that for the present practical applications will be limited to instruments, where it is desirable to have radioactivity generate a small current for measurement purposes.

•

Quick Make and Break Thermostat

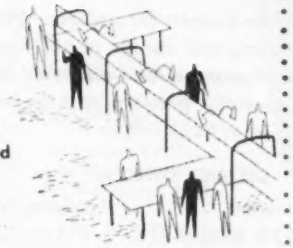
A quick make and break bimetal disc thermostat for defrost control and cycle termination where moisture

the truth about Dow Corning Silicones...

. . . is more fantastic than the patter of the pitchman or the spiel of the barkers that doubled in advertising and sales a generation ago. For example:

- **Silicone (Class H) electrical insulation makes motors and other kinds of electrical equipment last 10 times as long as they ever did before.**
- **These same insulating materials are used to double the power per pound ratio in electric machines.**
- **Silastic,* the Dow Corning silicone rubber is used to seal hot air at 600°F., hot oil at 350-400°F., limit switches and bomb bay doors at —100°F.**
- **Dow Corning Silicone oils and greases make permanent lubrication a practical reality.**

To many engineers and executives, such silicone facts as these still sound too good to be true. That's why we have built and assembled 16,000 pounds of demonstration units and typical applications to prove that our silicone products will do all that we claim for them. This is the first comprehensive Silicone Exposition ever assembled. Previewed in Washington, D. C. during the week of October 22nd, this exhibit will be given private showings in major industrial centers across the country.



DOW CORNING SILICONE EXPOSITION
now scheduled for

CLEVELAND
DETROIT
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NEW YORK
BOSTON
PITTSBURGH
CHICAGO
WICHITA
FORT WORTH
LOS ANGELES

If you want to know more about this Exposition write for complete information including our new 32-page book which answers in simple words and pictures, the $64 question, **"What's a Silicone?" Address Department AY-13**

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Midland, Michigan

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DOW CORNING CORPORATION MIDLAND, MICHIGAN

In CANADA: Fiberglas Canada, Ltd., Toronto • In GREAT BRITAIN: Midland Silicones, Ltd., London

Remember...

Creosote

is the only preservative that has kept wood sound and serviceable under severe conditions for more than 30 years

...creosote proves this statement with service records!

You can count on Koppers for creosote. With 18 creosote-producing and storage plants, Koppers can take care of your requirements. We'd like to give you our quotation when you're in the market for creosote. Get in touch with us.

DISTRICT OFFICES:

Woodward, Alabama	Birmingham 8-1611
Chicago, Ill., 122 S. Michigan Ave.	Webster 9-2400
New York, N. Y., 350 Fifth Ave.	Longacre 4-1130
Boston, Mass., 250 Stuart St.	Liberty 2-6525
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KOPPERS COMPANY, INC., PITTSBURGH 19, PA.

KOPPERS

All Standard Specifications

Creosote

The Performance-Proved Wood Preservative

beads are a problem has been developed by Stevens Mfg. Co.

A feature is an electrically independent bimetal thermal element which eliminates artificial cycling.

Units are molded in neoprene enclosures for moisture protection.

Thermostats are rated at 15 amp at 115 v. and 10 amp at 230 v.

Stevens Mfg Co, Inc, 69 So Walnut St, Mansfield, Ohio

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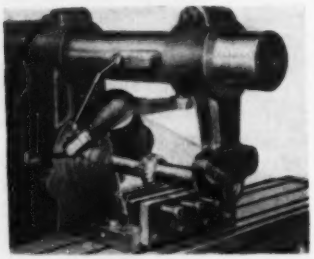

Portable Magnetic Base Light

The Enco Miti-Mite No. 250 holds up to a 100-w standard incandescent bulb and attaches magnetically with a 100-lb pull to curved or flat surfaces.

Unit consists of light, ball and socket assembly and magnetic base holder.

Enco Mfg Co, 4524 W Fullerton Ave, Chicago 39, Ill.

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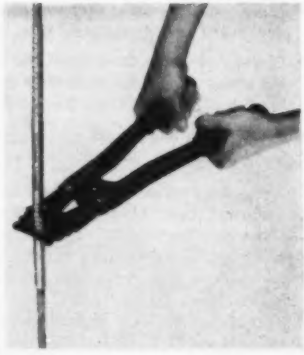


Splicing Tools

Two compact hand Hytools have been designed to install Hysplices for a wide range of conductors used in overhead lines.

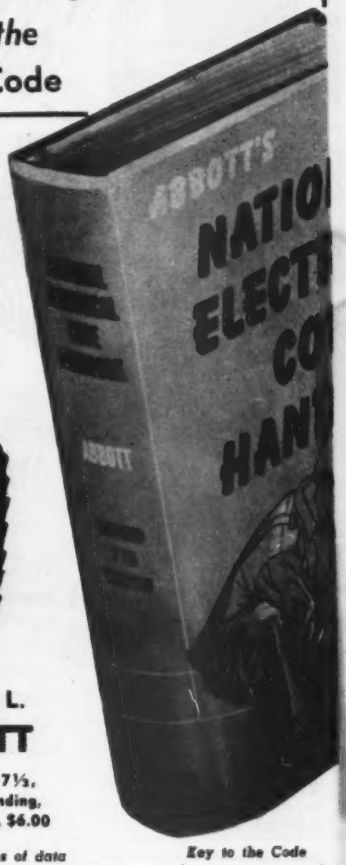
The new Burndy Hytools MD2-10 & MD2-12 are crimp type.

The MD2-10 is shipped with crimping grooves in position to install Hy-

How to handle all types of wiring and installation jobs

in strict accordance with the 1951 National Electrical Code

Here is the electrical contractor's job book completely revised to conform with the 1951 Code requirements and planned to enable electricians to understand and do work in accordance with the National Electrical Code. In Abbott's Handbook, you will find explanations of the rules and measurements for the various types of jobs—what they mean—how to apply them. With it, you can refer to any point about a wiring or installation job by means of the key on the cover and flyleaf—and have the full assurance that no rule which relates to the subject has been overlooked. Wherever a ruling in the Code lacks clarity, it is carefully reviewed and its practical application is explained. More involved Code paragraphs have been divided into short and simple rules; the order of some paragraphs and sections has been changed for easier reference; and many rules have been restated in simple language. Diagrams, sketches, and illustrations are used freely to help you understand the rules quickly and easily.



JUST OUT!

NEW 7th ED.—*ABBOTT'S*

NATIONAL ELECTRICAL CODE HANDBOOK

Here is an unusually practical book, especially planned for quick reference use by busy, practical men. It gives rules and requirements for all jobs in accordance with the latest National Electrical Code. *All rules for a job are grouped in one place.* With this Handbook to help you, you cannot miss a single rule and you cannot fail to understand all the rules. It thoroughly covers definitions of the terms used in the Code and general requirements applying to all wiring systems. It includes everything from special requirements pertaining to hazardous locations to complete tables giving the full-load current, wire size, conduit size, and branch fuse rating of various types of motors.

By ARTHUR L. ABBOTT

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A time and money saver

All in all, this Handbook is one of the most unusual and helpful electrical books published. It gives a wealth of information from the practical angle of getting jobs done according to legal requirements, and saving time and money in avoiding false starts, errors, and violations. At the same time, it provides a valuable general reference on many questions of materials, plans, wiring, and installation.

All the tables of data

which must be referred to frequently by users of the Code have been placed together in the last chapter in order to make them most convenient for quick reference. Here are tables of simplified data applying to the wiring and protection of motors of all ordinary types, sizes, and voltages; a table for calculating voltage drop; etc.

Key to the Code

A few minutes attention to the Key to the Code on the cover and flyleaf will give the reader a better idea of the scope and contents than could be obtained by two hours' study of the Code itself.

Read this partial list of contents:

- —approved types of wiring
- —installation requirements for all types of wiring
- —cable assemblies
- —requirements applying to all raceways
- —outlet, switch, and junction boxes
- —electrical appliances
- —generators — transformers
- —grounding
- —overcurrent protection
- —outside wiring
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General purpose transformers, 600 volts and below; 1-15 KVA inclusive, single or three phase

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450 KVA, Type F Unit Substation, 4160 V. Delta, 60 Cycles, 3 Ø— 120/208Y, 4 wire.

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splices on number 2-6/1 and number 4-7/1 ACSR. Reversing the jaws provides grooves for number 4-6/1 ACSR.

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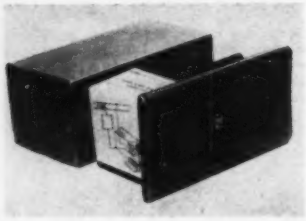

Radiant Heating Control

A new Mulvany air temperature and radiant heat control has been announced.

Model 5W may be used to control up to four 1000-w glassheat panels.

Thermostat is different in that no relays or transformers are needed, line-voltage control being used. Accuracy of thermostat is claimed to assure maximum comfort with minimum power consumption.

Continental Radiant Glass Heating Corp, 1 E 35 St, N. Y. C.

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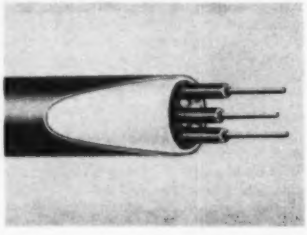


Electrical Metallic Tubing

A new plastic armored electrical metallic tubing for use in corrosive atmospheres has been announced.

Dekoron conduit is made by an extrusion process, a .020-in. coating of vinyl or polyethylene plastic being extruded over standard electrical metallic tubing.

Conduit is claimed to be unaffected by corrosive effects of moisture, salt air, acids, alkalies, oils and grease.

Recipe for making a room bigger . . . with light
Two ways to brighten a book . . . and a boy!
GENERAL ELECTRIC
GENERAL ELECTRIC
New beauty secret—"G-E Light Conditioning"

How to make these ads work for you

THE General Electric lamp ads, above, all feature Light Conditioning. They have run in full color in big-circulation magazines like The Saturday Evening Post, Better Homes & Gardens and Ladies' Home Journal. They are selling millions of home-makers—including many in your own service area—on the benefits of Light Conditioning.

These advertisements, and the continuing series of Light Conditioning ads to follow, can help to improve lighting standards in *your* area—if you tie in with a Light Conditioning program of your own.

For full information on how to plan a Light Conditioning program, call your G-E lamp District Office, or write Lamp Division, General Electric Company, Nela Park, Cleveland 12, Ohio.

GENERAL ELECTRIC

Sherman
Wedge-Grip
CONNECTORS

SC-12X, SC-6 and SC-6X have extra reinforcing plate for additional thread strength.

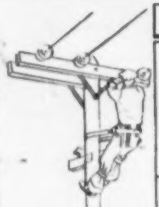
SAVE YOU 50% IN COST!

THEY'RE SOLDERLESS . . . V CORRUGATIONS CLAMP WIRES SECURELY . . . HAVE NO SEPARATE PARTS . . . REQUIRE ONLY SCREWDRIVER, WRENCH OR PLIERS TO INSTALL!

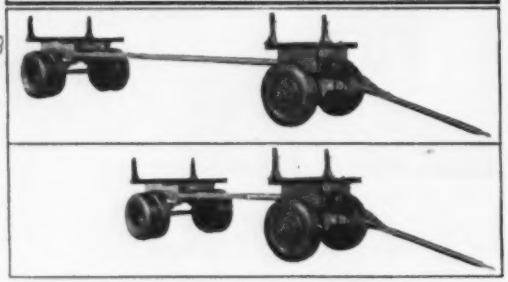
PART NO.		B & S WIRE	
Plain Screw	Hex. Head Screw	Max.	Min.
SC-6	SC-12X	2-12 Solid 2-6 Strand	2-20 2-12
	SC-6X	2-6 Strand	2-12
	SC-6X549	2-6 Strand	2-10
	SC-4X	2-4 Strand	2-8
	SC-2X	2-2 Strand	2-4

On many connections where you have made a slow, bothersome soldered splice or used more expensive connectors you can use "Wedge-Grips." These handy connectors help you stretch labor hours and keep costs down. Made of pure, high conductivity, hard drawn copper with bronze screws.

H.B. Sherman MANUFACTURING CO
BATTLE CREEK, MICH.
ELECTRICAL FITTINGS FOR WIRE and CABLE



DESIGNED TO MEET YOUR NEEDS...in Line Construction and Maintenance



ADJUSTABLE TO LONG OR SHORT POLES—
THE EAGLE 4-WHEEL TELESCOPING POLE TRAILER

Extend or shorten the wheel base of this heavy duty pole trailer, easily and quickly, by means of the telescoping center pole. Trails smoothly — without "snaking" or "weaving." Fully reinforced — a big trailer that does a big job. Full 90° turn front dolly — either direction — 5th wheel type steer. 9 tons capacity; over-all length extended, including tongue, 54 ft. 2 inches; telescoped 36 ft. 4 inches. Extended wheel base 40 ft. 3 inches; telescoped wheel base 22 ft. 5 inches. Equipped with electric brakes on rear wheels. Send for complete information on Model 6450 — Eagle Telescoping Pole Trailer.

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Send today for the complete catalog of Eagle Line Construction and Maintenance Equipment — a useful reference book

Standard compression type couplings and connectors, tape wrapped, are used at joints.
Samuel Moore and Co, Mantua, Ohio

MORE NEW PRODUCTS
about which you should know

Shallcross Mfg. Co, Collingdale, Pa. announces **improved type galvanometer system** featuring lighter weight and simplified construction. Coil and mechanism are mounted on rod supports. Units are available in four types having sensitivities per mm division of 4, 2, 1 and 0.5 microamps. . . . Mitchell Mfg Co, Chicago, Ill. reports two models of its Sovereign line are **eight foot Slimline** models offering long-term economy and high efficiency. Two T-12, 73w single pin lamps are used. Shielding angle is 45 deg crosswise and 30 deg lengthwise.

Daniel Woodhead Co, 15 N Jefferson St, Chicago announces an **all rubber locking plug cap** and connector, Turnex, that is interchangeable with other standard locking caps and connectors. Features are heavy duty rubber cover, laminated phenolic inserts and heavy brass contacts. Made in 10 amp-250v, and 15 amp-125v sizes. . . . The Dynakon Corp, 5509 Hough Ave, Cleveland 3, Ohio has developed a **high strength plastic rod,** Dynakon-F, with a dielectric strength of 325v per mil, arc resistance of 120 seconds and power factor of 4.24. Applications include stand off insulators, tension rods and structural members in corrosive atmospheres.

General Electric Co, Bridgeport, Conn., has designed a **moisture-resistant multi-control cable** around an open weave, Neoprene-treated fiberglass cloth. Fiberglass is claimed to improve crush resistance, deformation and moisture damage. Cable is suited for mining and machine control cables. . . . International Rectifier Corp, 6809 So Victoria Ave, Los Angeles 43, Calif. recently developed **hermetically sealed selenium rectifiers** designed for airborne applications. By series connecting, voltages up to 250 kv have been obtained. Units can be operated in ambient temperatures to 100C, and can withstand 100G's acceleration.

ACCORDING TO CHAPTER 10, TABLE 1
OF THE NATIONAL ELECTRIC CODE...

1 CM of COPPER INSULATED WITH A.V.C.®

Does the work of 1.6 CM of Copper with type RH

TABLE OF CURRENT CARRYING CAPACITIES

CM	Type AVA	Type RH
250000	296	224
300000	324	251
350000	367	273
400000	395	295
500000	442	334
600000	494	370
700000	526	405

Ambient Temperature 40°C - 104°F

This Means You Save 4 Ways:

USE SMALLER CABLE
to carry the same ampere load, or carry a greater load with the same size cable.

SAVE ON CONDUIT
because A.V.C. cable is smaller, or carry more current per conduit.

SAVE ON FITTINGS,
bushings, couplings, terminators, connectors, etc., because you use smaller cable.

SAVE ON LABOR
because A.V.C. is lighter and smaller. You can pull it through conduit easier, faster and cheaper.

Write for booklet "Cut Current Carrying Costs."

It's the

A.V.C.

"Sandwich" That Makes The Difference

OUTER FELTED ASBESTOS WALL

VARNISHED CAMBRIC

INNER FELTED ASBESTOS WALL

This *"sandwich"* protects the varnished cambric. It enables A.V.C. to carry more current than cables with conventional insulations.

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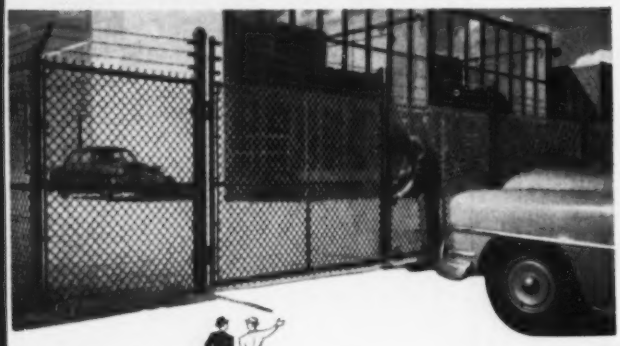

Sabotage is a danger which calls for vigilance day and night. Property line vigilance is the job for Page Chain Link Fence, now as it has been for more than 60 years. Consult the nearby, long-experienced Page Fence engineering and erecting firm, which will submit cost estimates without obligation. Name and address will be sent with illustrated fence data on request.

Write to PAGE FENCE ASSOCIATION in Monessen, Pa., Atlanta, Bridgeport, Chicago, Denver, Detroit, Los Angeles, Philadelphia, New York or San Francisco.

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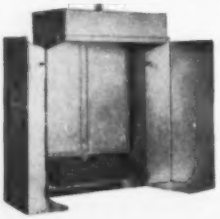
KEES Transformer Housing For 4 Transformers



2 CURRENT . . .

2 POTENTIAL . . .

No. 3624-14

- Accommodates high insulation types of GE & Westinghouse transformers. ratio 20 to 1, 2300-volt primary.
- Mounting-bar which supports the two current transformers may be attached vertically or horizontally.
- 16-Gauge zinc-grip sheet steel, welded construction throughout. Doors hinged on both sides, with hold-backs and latch.
- The two potential transformers rest on shelf which slopes to front of housing —gives added clearance, makes installing and replacing easier.
- Knockouts for insulator bushings are spaced to coordinate with current transformers mounted either in vertical or horizontal position.

Manufacturers of Meter Boxes, Pull Fuse Switches, Meter Test Blocks, Portable Handi-Lites

"SINCE 1874" *Write Dept. EW-11 for Free Catalog*

F. D. KEES MFG. CO.

BEATRICE NEBRASKA

WHAT THEY'RE SAYING

at industry meetings

A Dual Economy

James H. Jewell, *vice president, Westinghouse Electric Corp before Pacific Coast Electric Association, Honolulu, T. H.*

The electrical industry can meet the demands of a dual economy as well as the huge future growth forecast for the industry if it avoids complacency and realizes that service to the public is the keystone of the industry and its hope for prosperity.

Since 1939 the electrical industry's share of the gross national product has risen from 2.04 to over 4.05 per cent.

During this period electricity rates decreased 12% despite a rise of 210% in materials' cost and a rise of 109% in labor.

To aid the industry in meeting its future expansion, the engineering profession must be sold to high school students. In addition a return to the aggressive type of sales program must be made, and public recognition must be sought.

Rearmament Program

Philip Reed, *chairman of the board, General Electric Co before the International Conference of Manufacturers*

The U. S. is pushing the rearmament program too fast. The defense production program should be reduced or spread over an additional two to four years.

The peak expenditure rate of 65 or more billion dollars in 1953 should be cut back to 50 to 55 billions.

Corresponding re-phasing, according to individual needs and circumstances should likewise be effected in the programs of the other NATO countries.

Bureaucrats and Water Resources

Walter G. White, *chairman New Hampshire Water Resources Board before the New England Council*

The report of the President's Water Policy Commission, the Cooke Report, is pregnant with public power. There is an insidious group in the federal government that wants all fu-

ture power developed, distributed and controlled by the federal government.

The New England-New York Inter Agency Committee is attempting to set up a Northeast public power grid to include everything from Niagara to Passamaquoddy. Evidence of this is in the recapture clause found in a federal power license.

The Cooke report recommends that no more private hydro sites be developed, as they may interfere with a master plan by some federal agency.

The development of New Hampshire streams is as extensive and progressive as in any other part of the US. Yet the big bureaucrats want to study us as though we were a backward child. If the trend of the big bureaucrat is not arrested, we will find ourselves mooching handouts from Washington.

Electric Power Situation

H. F. McPhail, *director, Power Utilization Division, Bureau of Reclamation, before meeting of National Rural Electric Cooperative Association*

The capability of the Bureau of Reclamation's power plants has now exceeded 4¼ million kw. This year's energy production will approach 23 million kwhr. The Bureau's transmission lines now total some 56,000 miles.

The Bureau now operates, beside Grand Coulee Powerplant which is the largest in the world, some 22 powerplants with 10 more under construction.

People of this country have realized that electricity is a low cost servant, and have increased their use of it to such an extent that the demand is exceeding the generating capacity.

Ample power can be brought about by developing water resources in the West, and by increasing transmission capacity.

Colorado-Big Thompson project will soon make 125 mw of firm power available. In the Missouri Basin project, only 800 mw have been developed of a potential of 4½ million kw. The Bureau is in charge of marketing this power, and is already building transmission lines to move this power.

Hydro power should be pushed to meet our growing power demands, and fuel plants should be used only to supplement the hydro in order that oil and coal can be conserved. Our feasible water power is much greater than previously estimated.

SORGEL
AIR-COOLED
Dry-Type
TRANSFORMERS

Worth waiting for!

If you can wait a little longer than usual for Sorgel Air-Cooled Transformers, you will be well repaid for your patience, because you will then receive the best dry-type transformers made—well-known for its high standards.

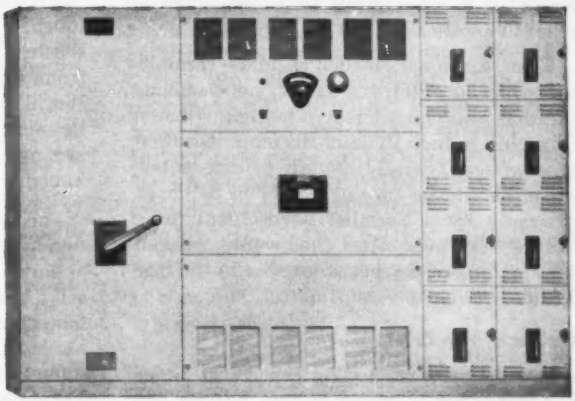
Increased orders and shortage of critical materials have caused our present longer deliveries. When the material shortage is relieved, our usual quick deliveries will be restored.

Order your anticipated requirements early, in order to obtain transformers when needed.

LIBERAL DESIGN for continuous hard service.
SUBSTANTIAL CONSTRUCTION for long life and endurance.
HIGH EFFICIENCY for economical operation.
CONVENIENTLY ARRANGED for easy connecting and simple installation.

Sizes ¼ to 2000 Kv-a. and all voltages up to 15,000 volts.

¼ Kv-a Single Phase 460/230 to 230/115 volt Transformer



2000 Kv-a 12,000 volt sub-station, with primary fused load interrupter switch, temperature indicator and alarm, and extra contacts that may be used to operate forced draft fans to increase capacity 25%

Sales Engineers in Principal Cities

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Pioneers in the development and manufacturing of Air-Cooled transformers

HOW TO HELP BRITAIN ...and Ourselves

The purpose of this editorial is to help Winston Churchill obtain the aid Britain needs

(1) to weather her present financial crisis, and

(2) to avoid a chronic recurrence of such crises.

This is not a philanthropic purpose.

Britain is our staunchest ally in the free world's continuing fight for survival. She cannot perform her role effectively if she is broke, or if she careens from one financial crisis to another.

Then, too, a nation such as ours—committed to private enterprise as a way of economic life—has a special interest in helping Winston Churchill to help Britain. His administration is relatively friendly toward private enterprise. Should he fail, he would be replaced promptly by a Socialist government more hostile than ever. And that would weaken the standing of private enterprise in the free world.

Cause of the Crisis

It is the drive of the Western World under our leadership to rearm against Russian aggression that has precipitated Britain's financial crisis. It set off a scramble for raw materials from which armaments could be made, and for many other materials that might be short in the event of war. So the prices of the things that Britain must import—mostly raw materials—have been boosted more than the prices of things she can export—mostly finished products. That leaves Britain short of funds to pay for essential imports. This difficulty increases as the necessity becomes more urgent to divert industrial effort from production for export to production for security.

The Basic Trouble

Although Britain's immediate crisis was touched off by the rearmament drive of the Western World, her basic affliction is one from which she has suffered since the end of World War II. Stated in its simplest terms, Britain does not produce enough goods to pay her own way as one of the family of free nations.

For years this deficiency in home production was made up by income from shipping and overseas investment. But Britain had to sell a large part of her foreign investments to finance her heroic part in World War II. So her income from that source has been greatly reduced. And, in spite of an increase of about a third above prewar in her own production of goods and—thanks to a continued "austerity" program—a much larger increase in her exports, Britain still is not paying her own way.

Two Ways to Solvency

Britain has two ways to restore her solvency. One is to cut down on what is consumed—the belt-tightening process. The other is to step up British production.

To surmount the present crisis, Mr. Churchill has asked for some cutting down. He probably must ask for more.

Except as a stop-gap expedient, however, more cutting down of Britain's consumption is clearly a dangerous course. That would further depress a British standard of living which, not more than half as high as ours, already is too low. Politically such a course would grease the skids for Winston Churchill's administration, even now governing by a wafer-thin parliamentary margin. Also, as *The* (London) *Economist* remarks, the "lazy expedient of cutting trade" would result in "hurting other people and forcing them to take similar action"—by cutting the market for their products.

The Only Cure

The best and, in fact, the only way to help cure Britain's economic ills is to help Britain produce more. Here the technical possibilities are encouraging. On the average, the British industrial worker produces only about 40 percent as much a year as the American worker. That is a British estimate, made by Sir Ewart Smith.

Wider use of better industrial methods and modern tools and an infusion of the competitive incentive into British industry — to replace the cartel and other restrictive practices — would go a long way to narrow this wide gap in worker productivity. This is the consensus of experts on both sides of the Atlantic.

Since 1948 the Anglo-American Council on Productivity has done much to encourage output per man-hour in Britain and to foster this doctrine with both labor and management. But much yet remains to be done.

In the United States it is increasingly suggested that before we give Britain any more economic aid we should insist that everything possible be done to exploit the technical possibilities of increased production. This emphasis on production is needed. But if we Americans were to impose upon the hard-pressed British people conditions that could be construed as an affront to a friendly and sovereign nation, we might well put into the hands of a masterful rabble-rouser such as Aneurin Bevan, the anti-American leader of the Labor Party's left wing, a campaign issue on which to maneuver himself into the Prime Ministership.

Churchill Can Insist

But Winston Churchill is not so handicapped as we should be in imposing prerequisites of further aid. As Britain's own, most honored leader he will raise no touchy questions as to Anglo-American relations if he insists that Britain have firm plans to cure her economic ills, plans sharply focussed on ways and means of increasing Britain's industrial efficiency.

By presenting a convincing plan to cure Britain's recurring crises through greater production, Mr. Churchill will greatly facilitate the process of getting the aid his country must have. He will also remove an increasingly dangerous element of dissension in Anglo-American relations — the feeling of many Americans that more aid to Britain is more money down the drain. The way to counter that feeling is to come up with a prescription for an economic cure, not a request for another economic poultice.

Technically, such a program is entirely feasible. It will perhaps be the supreme test of Winston Churchill's statesmanship to make it politically feasible as well.

In the interest of Britain, of the United States and of the whole free world, we wish him all success.

McGraw-Hill Publishing Company, Inc.

NEWS ABOUT PEOPLE

Portland GE Appoints Millsap and Bosch VPs

Portland General Electric Co has advanced Ralph H. Millsap and Frank A. Bosch to vice presidents. Millsap has been director of public relations and Bosch assistant to the chairman of the board.

In another promotion, Theodore W. Fryou, treasurer of the company, has

R. H. MILLSAP

F. A. BOSCH

received new duties under the title of treasurer and controller.

Following a newspaper career in the early '30s, Millsap became advertising manager for Portland General Electric in 1938. He advanced to manager of public relations and advertising in 1945, following his release from the Navy where he held the rank of commander. He was named director of public relations in 1947.

During the years 1921-33 Bosch was with Blyth & Co, after which he was secretary-treasurer for Warrens, Bosch & Floan, investment bankers, until 1941. He was associated with Gunderson Brothers Equipment Corp from 1941 to 1948. In 1948 he became assistant to the chairman of the board of Portland General Electric.

Fryou joined the company as an accountant in 1928 and was appointed assistant general auditor in 1939, and general auditor in 1942. In 1945 he was named controller and became treasurer in 1948.

•

William P. L'Hommedieu, assistant manager of the Pacific Coast district of Westinghouse Electric Corp, has retired. He started with the company in 1906 at East Pittsburgh, Pa. He served as Pacific Coast manager of the company's Central Station Department and in 1939 was put in charge of sales of electrical apparatus to electric utility organizations in nine western states, Alaska, and Hawaii.

Lee C. Howley, who joined Cleveland Electric Illuminating Co in July, 1951, has been elected general counsel of the company. He succeeds **Ralph M. Besse,** vice president, who has relinquished his duties as general counsel in order to devote more time to his work on the firm's administration committee. Howley, former Cleveland law director, previously had served as an assistant in the U. S. District Attorney's office in Cleveland.

John H. Brown, superintendent and operator of the Carolina Power & Light Co substation at Greeleyville, S. C., since its erection in 1945, has been transferred to Asheboro, N. C. There he will be in charge of six substations for Carolina P&L. **Baxter Clark** will succeed Brown at Greeleyville.

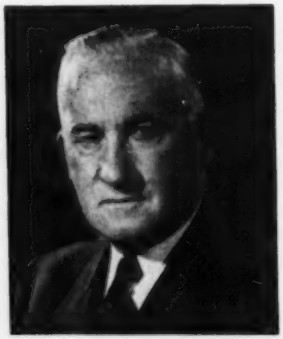
John L. Fuller, technical coodinator of Reliance Electric & Engineering Co since 1950, has been made manager of research and technical services. Fuller joined the company in 1936 as an engineering trainee.

H. L. Winje, formerly president of the Acrometal Products Co, Minneapolis, has been appointed general sales manager of American Creosoting Co, Chicago.

Walter Dreyer Named a VP by Pacific G & E

Walter Dreyer, chief of the division of civil engineering of the Pacific Gas & Electric Co since 1944, has been named vice president and chief engineer succeeding I. C. Steele, who has retired after 42 years with PG&E.

The utility also named K. C. Christensen treasurer to replace E. J. Beck-



WALTER DREYER

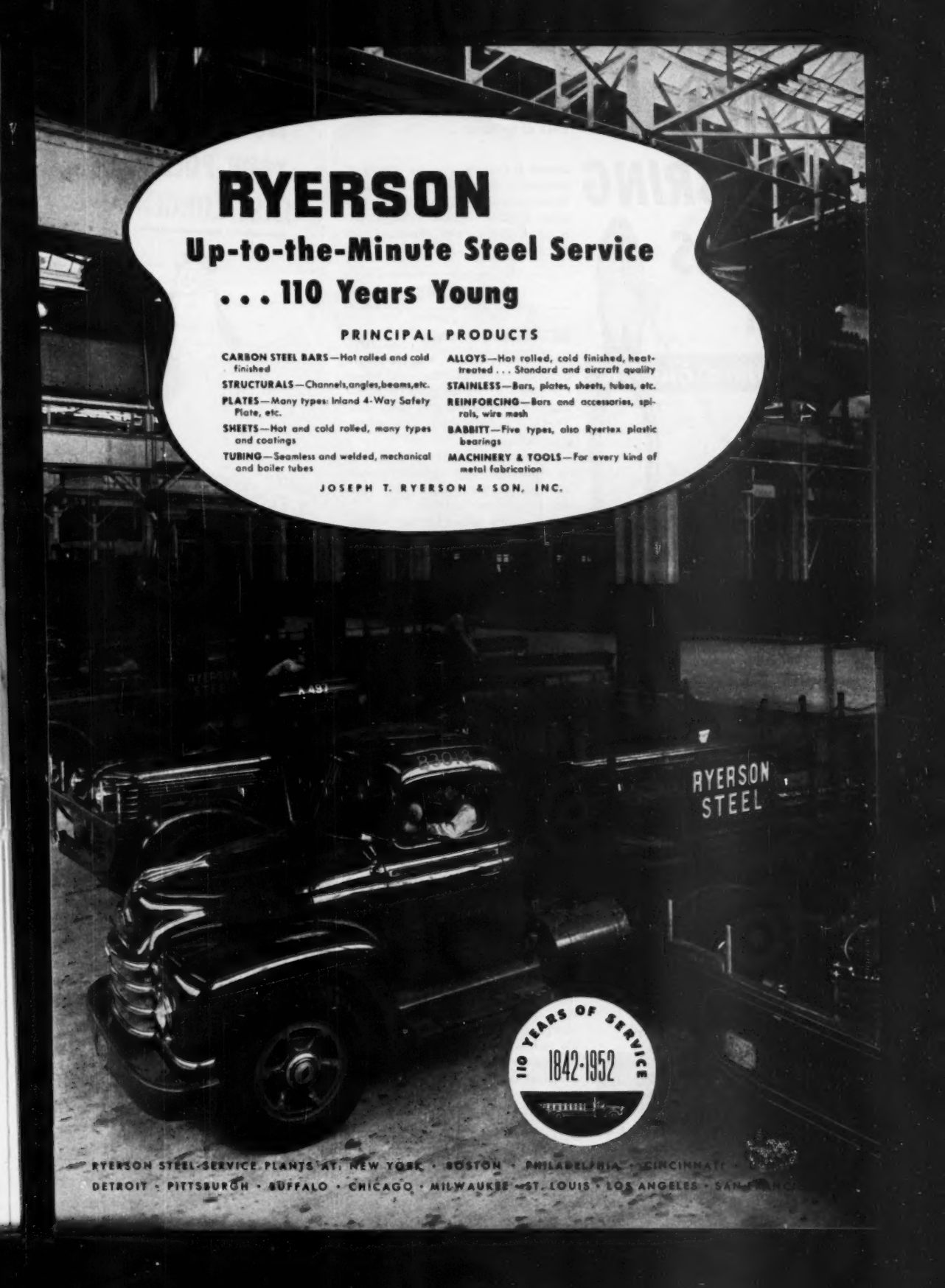
ett, a 36-year veteran of the company, who also has retired.

Dreyer started with Pacific G&E as a surveyor in 1916. Four years later he became assistant engineer in charge of structural and hydraulic design. He was made assistant chief of the division of civil engineering in 1929.

Christensen joined the company in 1931, starting in the evaluation department. Thirteen years later he transferred to the treasurer's office, becoming assistant treasurer in 1944.

In 1909 Steele was employed by Pacific G&E as a laborer and within a year was made general foreman on a diversion dam project. In 1914 he became assistant engineer and superintendent in charge of building construction, in 1917 was appointed a civil engineer, and in 1921 was made chief of the division of civil engineering in the engineering department. He became chief engineer for the company in 1944, and vice president three years later.

Beckett began his career with PG&E for the second time in 1915, having worked for the utility for a year in 1911. He served successively as secretary to the vice president and



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Up-to-the-Minute Steel Service . . . 110 Years Young

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CARBON STEEL BARS—Hot rolled and cold finished

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UTICA *LUBRING* PLIERS AT *Western Electric*

At Western Electric, Utica's *Lubring* line of pliers ...with built-in lubrication...is used for a wide variety of in-plant and field jobs.

Utica's *Lubring* line of finest pliers has a ring of oil-impregnated porous iron floating in the joint . . . slowly feeding lubrication for smooth action, long life.

Drop forged, precision machined, with cutting edges hardened by a special Utica process, the Utica *Lubring* line has the heft, feel and rugged power for continuous daily use.

Your tool supplier can tell you more about *Lubring* and other Utica pliers . . . or write direct to

UTICA Drop Forge & Tool Corp.
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AND THE WORLD'S BEST TOOLS ARE MADE IN U. S. A.

treasurer, assistant treasurer, financial assistant to the president, and since 1943 as treasurer.

•

Joseph J. Carlson, assistant plant production manager of Bogue Electric Manufacturing Co, has been made works manager. Before joining Bogue in 1947, Carlson was associated with Permutit Co for 11 years.

OBITUARY

M. Wilson Arthur

M. Wilson Arthur, 61, vice president and director of Consumers Power Co, died Jan. 4 at Jackson, Mich. He had general supervision of sales, rates, employee and public relations, and the legal department.

Arthur went to Jackson in 1933 as vice president and assistant general manager of the company and was elected a director in 1949.

Arthur first started his career when he took an engineering apprentice course in the Westinghouse Electric Co plant at East Pittsburgh, Pa. In 1913 he became sales engineer for

M. W. ARTHUR

Westinghouse at Cincinnati, Ohio. Five years later he was appointed commercial manager for the Northern Ohio Traction & Light Co at Akron and in 1926 became manager of electric sales and distribution for its successor Northern Ohio Power & Light Co, a predecessor of Ohio Edison Co. Three years later he was called to New York City as assistant to the vice president of Allied Power & Light Co and its successor, Commonwealth & Southern Corp, and became a vice president and director of Ohio Edison, Pennsylvania Power Co, Akron Transportation Co, and Penn-Ohio Coach Lines.

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YOUR POLES
LAST LONGER
AND LONGER...
AND LONGER...
AND LONGER...
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OSMOSE
INSPECTION AND
TREATING PROGRAM
This program, performed by our highly skilled crews, can save your system hundreds of thousands of dollars in REPLACEMENT COSTS by
1. Absolutely arresting groundline decay of your poles and
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Treatment charge is as low as 4% of replacement costs and pole life is extended for approximately 8:10 years.
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OSMOSE WOOD PRESERVING CO., INC.
BUFFALO

"AND WE THOUGHT WE DIDN'T HAVE ANY SCRAP!"

"We don't make anything of steel . . . so we didn't think we were concerned in the national scrap program.

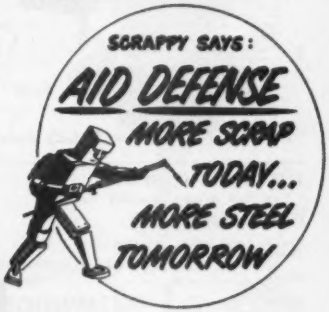
"Then we came to realize how badly *we* would be affected if steel products we *use* were shut off by the shortage of scrap.

"When we learned a *photographic film* manufacturer was able to collect 88 *carloads* of iron and steel scrap in his own plant—we began looking.

"We found plenty of idle metal that had rust on it and dust on it. Obsolete machinery. Outmoded equipment, jigs and fixtures. Broken parts—like wheels, chain, springs. Abandoned structures made of steel.

"We found plenty. And, knowing our best chance of *getting steel products* was by furnishing the raw materials for steel-making, we promptly called in our local scrap dealer.

"I'd urge *any* business to look over its premises with an eye out for scrap. Non-ferrous scrap is needed, too! Why don't *you* appoint one man—with authority—to act as *your* Scrap Salvage Director?"



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SLASH OPERATING COSTS...

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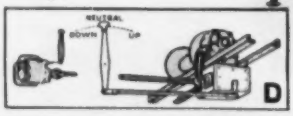
For installation on your present truck — or on new equipment

A **POLE HOLE DIGGER** . . . Uses your regular derrick and crew. Attaches by a single bolt to power take-off shaft. Adjustable for clean holes up to 10 feet deep. Interchangeable augers 8 to 20 inches diameter.

B **DERRICKS** . . . Both "A" frame and "T" type for front or rear mounting on all makes of trucks.

C **UTILITY CABINETS AND MATERIAL RACKS** . . . Bolts onto any flat bed truck. Gives needed facilities for pole line work at a fraction of the cost of a utility body.

D **WINCH DRIVE BOX** . . . Gives instant forward and reverse action to your winch. Permits operator to give all his attention to the winch job and speeds up work. *Easy to operate:* Simply engage power take-off just once. No further shifting to PTO or use of truck clutch required. Just move a single cab lever forward or backward to lower or raise the winch line. Available for single or double drum winches.



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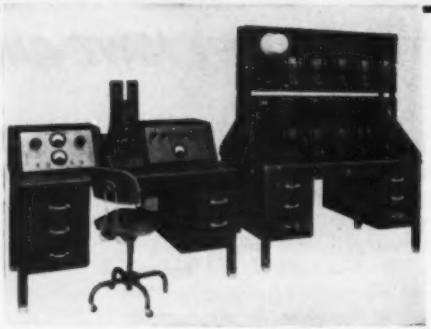
STATES new, versatile FORM "FDM" THERMAL DEMAND TABLE For Quicker, Easier, Testing

The States new Form "FDM" Thermal Demand Control Table and accompanying Form "FDMR" Meter Rack Table, shown in illustration, is designed to simplify your meter testing problems.

LOOK AT THESE ADVANTAGES

1. One, or any number of meters up to capacity of rack may be tested.
2. Current, Potential and Wattage conditions known to operator at all times and power factor easily ascertained.
3. Phasing and loading regulators provide immediate control for varying conditions.

And many others.



Form "FDM" Control Table • Form "FDMR" Rack Table

Send For Further Details today!

THE STATES COMPANY
5 New Park Avenue, Hartford, Conn.

I am interested!

Please send latest information on Form "FDM" Thermal Demand Table.

Name ..... Title.....

Firm .....

City ..... Zone..... State.....

THE STATES COMPANY

3 NEW PARK AVENUE
HARTFORD, CONN.

Helmuth C. Gardett

Helmuth C. Gardett, 73, retired chief electrical engineer of the Los Angeles Department of Water & Power since 1944, died Dec. 25 in Los Angeles.

Gardett began working for the City of Los Angeles in 1906 and when its Bureau of Power & Light was created about a decade later he served as an assistant electrical engineer. He was placed in charge of the design and construction department in 1917. In 1938 he was made assistant chief electrical engineer and two years later chief electrical engineer and head of the bureau. The power and water bureau was consolidated in 1943.

Gardett had charge of most of the municipal power system's major construction, starting with the first power plant in San Francisquito Canyon and the transmission line to Los Angeles. Among other projects he carried out were the Hoover transmission line and the harbor steam plant.

•

Harold S. Sines, 61, vice president of Electroline Co, Chicago, died recently at Dyer, Ind.

Edgar B. Chesnutt, 45, advertising director of Arkansas Power & Light Co since 1942, died Dec. 17 at Little Rock, Ark. In addition to his career as a utility advertising executive, Chesnutt had been active in the newspaper field in the Southwest.

W. M. Slayton, 50, manager of the Arkansas Power & Light Co office at Gurdon, Ark., for 32 years, died Dec. 18 at Gurdon. Slayton started with Arkansas P&L in 1915 and except for a year in the Army in 1919 worked for the firm continuously.

Christian Karn, 57, supervisory engineer for the Public Service Electric & Gas Co at Elizabeth, N. J., died in that city Dec. 30. He had served the utility 28 years.

Norman H. Barnes, 55, sales manager for Potomac Electric Power Co, died Jan. 1 at Washington, D. C. He was associated with the utility 35 years.

John J. Caddigan, 73, former assistant vice president and advertising manager of Boston Edison Co died at Corning, N. Y., Jan. 1. Caddigan joined the

utility in 1904 and served in various posts in the advertising and promotion departments. He retired in 1949. One of his noteworthy contributions to the entertainment world was his composition "The Rose of No Man's Land," a famous song of World War I.

Edward N. Strait, 66, who retired in 1950 after 34 years as manager of the rate and research department of Pioneer Service & Engineering Co, Chicago, died at Chicago Dec. 23. Strait was a pioneer in public utilities regulation and also worked for the War Production Board during World War II.

Julius E. Schoeller, a civil engineer for the Commonwealth Edison Co and its predecessors for 41 years, died recently at Evanston, Ill. He retired in 1948.

Leon Morrison, 50, operating superintendent of the Northern Division of New Jersey Power & Light Co since 1944, died at Newton, N. J., Dec. 24. Morrison was employed by the company in 1920 as a clerk in its Dover office. Two years later he was transferred to Newton and worked there until his death.

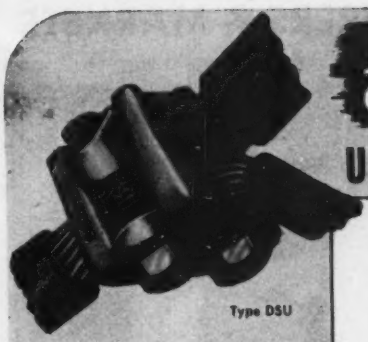
John T. Baureis, 59, superintendent of the Utility Department of the Borough of Milltown, N. J., died Dec. 21 at Milltown. Baureis had been with the department for 35 years.

Dr William F. Clapp, 71, authority on oceanic biological problems, died at Duxbury, Mass., Dec. 28. He was a consultant of public utilities on many construction jobs and for years operated the laboratory bearing his name at Duxbury.

Prof William C. Osterbrock, 58, head of the electrical engineering department at the University of Cincinnati College of Engineering, died recently at Cincinnati, Ohio.

Harland W. Bowen, 49, who was in charge of electrical equipment at Tennessee Valley Authority died Dec. 17 at Knoxville, Tenn. Bowen had been with TVA since 1936.

Charles Berry, 86, retired manager of the Pittston, Pa., division of the Scranton Electric Co since 1944, died Dec. 31 at Swampscott, Mass.



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A one-piece bolt type variable service tap. For large size copper cables. Available in conductor sizes from 1/0 to 1,000 MCM. Made of high strength copper alloy and equipped with Duronze bolts. Rugged, compact, facilitates neat taping.

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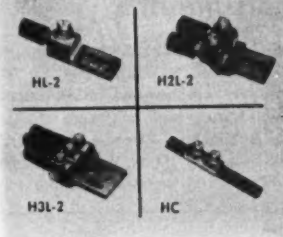
VARIABLE HERCULON CONNECTORS

For power distribution jobs. Available in eight sizes to cover range of cable No. 8 solid to 1,000 MCM.



DOSSERT MFG. CORP.

GET THE BEST IN OUTDOOR BUS SUPPORTS—Specify 3E!

Your problem of supporting outdoor busses and connections can be satisfactorily solved by specifying the "Three E" Form D line.

Bus supports are available for flat bar, tubing, rod, cable or wire, in voltages ranging from 7500 to 69000. Nema standard insulators are used. Clamps are of rugged design and by use of a small adapter can be adjusted so that bus may be run at any angle to mounting surface. Husky malleable iron bases permit of mounting on pipe when so required.

Write for Bulletin 271 for complete details.

ELECTRICAL ENGINEERS EQUIPMENT CO.

MELROSE PARK, ILLINOIS

MANUFACTURERS & MARKETS

Delivers 1 Millionth Instrument

Leeds & Northrup Co, Philadelphia, Pa., recently delivered its one millionth instrument to the National Bureau of Standards at Washington, D. C. The instrument, an automatic Speedomax Recorder, will be used in conjunction with research on the behavior of molecules. Interested onlookers are (left to right) Dr Raymond C. Machler, Leeds & Northrup director of research; George W. Tall, Jr, vice president of the firm; Dr Allen V. Astin, acting director of NBS; Dr Earle K. Plyler, chief of the NBS Radiometry Laboratory.

Defense Receives Over 70% of Alcoa's Aluminum

Broad and rapid expansion of Aluminum Co of America's facilities for aluminum production for military and essential civilian needs was the company's biggest and most important job throughout 1951. This was revealed by I. W. Wilson, president of Alcoa, in a year-end statement.

In the statement, Wilson emphasized the tremendous plant-building program undertaken by Alcoa under government certification will increase the company's aluminum producing capacity by a full 55% and is moving ahead at full speed.

The government also has authorized Alcoa to add a total of 205,000 tons to its annual aluminum-smelting capacity, all of which is expected to be in operation before the spring of 1953.

Because of steadily increasing military and defense needs for aluminum, more than 70% of aluminum shipments by Alcoa are going directly into the defense program and the balance is being shipped for use in defense supporting and essential civilian production, Wilson stated. He added that although aluminum for civilian applications is in severely short supply at present, the company is optimistic concerning the long-range supply situation.

Wilson declared, however, that the present situation reflects the fact that aluminum is not available today in the so-called "free" market place. "All Alcoa metal production is shipped as directed by the government under the Controlled Materials Plan," he said.

•

1951 Aluminum Output 17% Above 1950 Yield

Total production of primary aluminum in the United States during 1951 is estimated at 1,680 million lb, or almost 17% above 1950 production, the Aluminum Association has reported.

Output, according to the association, would have been higher but for power shortages in the Northwest and Southeast which curtailed production during the late summer.

Despite curtailment in use for nonessential purposes caused by demands of the defense program and reduction in imported metal, the aluminum industry increased its primary capacity about 20% in 1951.

Increases in primary aluminum capacity scheduled since the outbreak of hostilities in Korea total approximately 1,500 million lb. About 1,100 million lb of this amount will be in new plants and 400 million in existing plants. When all the new facilities are in operation, the industry will have doubled the primary capacity it had at the close of 1950, for a total of about 3 billion lb.

•

Electrical Sales Decline Is Predicted for 1952

Sales of electrical appliances, machinery, and equipment in 1952 will be slightly below the sales peak of $12 billion set in 1951. This prediction was made by W. J. Donald, managing director of the National Electrical Manufacturers Association, and A. J. Nesti, its chief statistician.

The electrical manufacturing industry, according to NEMA, will produce in 1952 only those products that the defense and civilian economy will permit. Total business in the industry is expected to continue at a high level, but dislocations in its various branches will probably be greater than last year.

Association officials stated that 1952 will resemble the latter part of 1951 in electrical manufacturing. In the final months of last year the effects of material shortages and increased defense production combined to create serious declines in output of electrical appliances, illuminating equipment, and electrical building equipment and supplies.

Total sales of electrical products in 1951 exceeded 1950 sales by 20%. The $12 billion represented a real gain, even allowing for the factor of inflation, the association exceutives said.

MANUFACTURING BRIEFS

Dow Chemical Co's Magnesium Sales Department has assumed distribution of cathodic protection products from Dowell, Inc, a wholly owned subsidiary.

Square D Co, Detroit, has announced plans to build a new plant in Seattle which will more than double the space of its present facilities there. Construction will begin within the next

few months on a 52,000-sq ft plant site. The new facility, which will produce electrical industrial controls and distribution equipment, will be the first of a number of plants to be built by the firm in strategic locations throughout the country.

Reliance Electric & Engineering Co has put into operation its new $1.8-million Euclid (Ohio) Plant, after moving from the firm's two plants in Cleveland. The new facility, which employs 425 persons, is a single story structure 442 ft long and 352 ft wide with a total floor area of 133,000 sq ft.

Westinghouse Electric Corp has opened an engineering and service department laboratory at 1300 Oak St., Kansas City, Mo. The company's services will include the reconditioning of electrical apparatus such as motors, transformers, and other equipment. Repair facilities costing about $125,000 will be installed in the new service center.

General Electric Co has announced plans for an expansion program costing over $5 million to increase the production capacity of its silicone plant at Waterford, N. Y. Additional manufacturing facilities for the Waterford plant, located on a 65-acre site, are now being installed and new facilities are expected to be in operation by the end of 1952.

SALES ASSIGNMENTS

COMPANY STAFFS

Graybar Electric Co has appointed S. M. Lawrason manager of its Baton Rouge Branch. Lawrason joined Graybar at New Orleans as a salesman in 1941. He transferred to Baton Rouge as sales manager in January, 1951, when the branch was opened.

Nordberg Manufacturing Co, Milwaukee, Wis., has opened a branch office in Seattle. In establishing this office, Nordberg has acquired the entire sales and service facilities of Al-Pac Engine & Equipment Co. Carl S. Harris, manager of Al-Pac prior to its acquisition by Nordberg, has been appointed manager of the new West Coast branch.

Metal Prices
Jan. 7, 1952

COPPER, Conn., V., lb	$ .24½
LEAD, N. Y., lb	.19
ZINC, prime Western, E. St. Louis, lb	.19½
TIN, Straits, qual. N. Y., lb	1.03
ALUMINUM, ingot, base price	.19
NICKEL, base price	.56½
STEEL, billets, Pitts., ton	56.00
STEEL, scrap, No. 1 heavy, Pitts., ton	45.00

3 Advantages!
* LOW COST
* Makes High Pressure Connection
* Neat, Compact and Easy to Tape
UL
BLACKBURN
Hi Strength
TWO-BOLT CLAMP
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Ideal for taps, other connections, and dead-end snubbing on cables from 1/0 to 1,000,000 CM. Heavy, sturdy construction, yet compact and easy to tape. Produces very tight, high-pressure, trouble-free connections. For the best in quality at low cost, specify BLACKBURN.

1952 EDITION JUST OUT

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- *Complete* line of instrument transformers described on 94 illustrated pages
- Ordering information for both indoor and outdoor types
- Includes ratings, ASA accuracy classifications, prices
- Also, numbers for supplementary, technical bulletins

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Schenectady, New York

Please rush my copy of the new "1952 INSTRUMENT TRANSFORMER BUYER'S GUIDE" (GEA-4626E).

( ) Planning immediate project
( ) Reference

Name ..... Position .....
Company .....
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Do those plowed field jobs this winter when the ground is frozen!

Bore through FROZEN Ground
WITH A
PENGO Auger

- ★ *Avoid crop damage*
- ★ *No getting stuck in the mud*
- ★ *Improve public relations*

DO a faster, *better* job with a scientifically-designed PENGO Auger—the twin-helix auger that bores clean, true holes in any kind of soil, most sandstones, hardpan, decomposed rock, frozen ground—and even in permafrost. Saves power, cuts maintenance to a minimum! 15 sizes; to fit any earth boring machine.

★ **ORDER NOW** *or write today for data and prices*

PETERSEN ENGINEERING CO.
MANUFACTURERS
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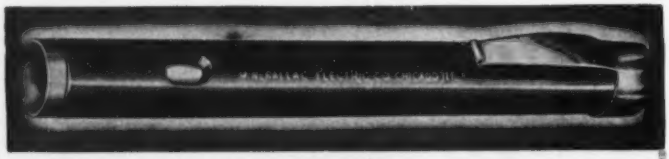

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MANUFACTURERS OF STATISCOPES, HANGERS, CLIPS, STRAPS, INSULATING AND CABLE-PULLING COMPOUND
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Write for information and prices
WHITAKER REEL MANUFACTURING CO.
P. O. Box 1318 Monroe, Louisiana

BUY
all the U. S. Savings Bonds you can and
KEEP
all the U. S. Savings Bonds you buy

New Electrical Construction

New electrical construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included.

UTILITIES

Proposed Construction

Arizona—Mohave Electric Co-operative, Kingman, 39 mi. distr. lines, Kingman Co. $107,000. Ball & Green, 197 E. 14 St., Tempe, consult. engrs.

La., New Roads—Town, furnishing, installing, duel fuel engine of 900 to 1,000 hp. with 2,400 volt alternator exciters auxiliaries, piping and wiring. Plans deposit $5, Barnard & Burk, 1023 Nicholson Dr., Baton Rouge, engrs.

New Mexico—Central Valley Electric Co-operative, Artesia, 167 mi. rural distr. lines 18 mi. tie lines, complete previously approved construction and headquarters facilities, Eddy Co. $1,000,000. H. N. Roberts & Assoc., Lubbock, Tex., consult. engrs. Paul L. Frost, c/o owner, engr.

Oklahoma—Oklahoma Gas & Electric Co., 321 N. Harvey St., Oklahoma City, 30 mi. 138 kv rural distr. line from Maud to Sulphur, Murray Co. $175,000. R. F. Danner, c/o owner, engr.

Ont., North Bay—R. P. Opie, 441 Queen's Quay, Toronto, electrical and alarm systems. Plans deposit $50. Defence Construction (1951) Ltd., 70 Lyon St., Ottawa, engr.

Ont., Ottawa—Canadian Broadcasting Comn., 1231 St. Catherine St. W., Montreal, Que., new transmitter station, $335,000.

P. E. I., Summerside—P. J. Mangan, 1032 Gottingen St., Halifax, N. S. electrical distr. sys. at R.C.A.F. Station for Govt. of Canada, Dpt. National Defence AIR, Cartier Sq., Ottawa, Ont. Plans deposit $50. Defence Constr. 1951 Ltd., 70 Lyon St., Ottawa, Ont., engr.

Low Bidders & Contracts Awarded

Florida—Irby Constr. Co., 817 S. State St., Jackson, Miss., CA, $144,671, 110.5 mi. rural distr. lines, Madison Tri-County Electric Co-operative, Madison, Fla. E. P. McLean Eng Co., 815 S. Main St., Moultrie, Ga., engr.

Ill., Chicago—Chas. B. Johnson & Son Co., 6 N. Michigan Ave., Chicago, 2, Ill., Ca, $600,000, power plant addn. Campbell Soup Co., 2550 W. 35 St., Chicago, Ill. Bids Oct. 26, awarded Dec. 18.

Kansas—Thompson, Haight & Keister, 2006 N. Portland Ave., Oklahoma City, 7 Okla. CA $168,887. 39.6 mi. rural distr. lines, sys. imprvs., Dickinson Co. R. S. & O. Rural Electric Co-operative Assoc., Solomon, Kan. Richardson Electrical Eng. Co., Solomon, Kan., engr.

Kentucky—Real Electric Co., 1701 Triplett St., Owensboro, Ky. CA $78,496. Sect. 2, 4.36 mi. 69 kv transmission line, 1,500 kva sub-station, Nelson Co. Salt River Rural Electric Co-operative Corp., Bardstown, Ky. Fleming & Patterson, 508 E. Main St., Lexington, Ky., engrs.

Md., Annapolis—Blumenthal-Kahn Electric Co., 43 S. Liberty St., Baltimore, Md. LB $192,300, incl. Alt. 2A grading, electric transmission line, Annapolis Experiment Switching and Metering Station for submarine test. Pub. Wks. Office, U. S. Naval Academy, Annapolis, Md. Bids Dec. 11.

Montana—S. T. Olson Co., Box 249, Billings, Mont. CA $124,583. 89.28 mi. rural distr. lines, sys. imprvs., Wibaux Co. Goldenwest Electric Co-operative, Wibaux, Mont. State Water Conservation Bd., 207 Mitchell Bldg., Helena, Mont., engr.

Nebraska—Peters & Doyle Constr. Co., Albion, Neb., CA $200,205, 54.45 mi. 34.5 kv rural distr. line, Perkins Co. Midwest Electric Membership Corp., Grant, Neb. Raymond H. Reed, 2305½ 13 St., Columbus, Neb. engr.

New Mexico—C & W Constr. Co., Ada, Okla., CA. $447,983, 351.5 mi. rural distr. lines and sys. imprvs., Lea Co. Lea County Electric Co-operative, Lovington, N. M. H. N. Roberts & Assoc., 1310 Ave-

NOW

SEYMOUR SMITH presents

PRUNING SAWS

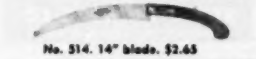
FASTEST, EASIEST CUTTERS ON THE MARKET

For years, arborists have looked to Seymour Smith for top quality pruners, loppers, trimmers, pole saws, etc.

Now, Seymour Smith presents a new and complete line of pruning saws—*the fastest, easiest cutters on the market.* Our own design, with needle point teeth in blades of famous Swedish charcoal steel set in laminated hardwood handles. Six models, covering all requirements up to chain saw work.

No. 922. 22" blade. $4.25

No. 622. 22" blade. $5.75



No. 314. 14" blade. $2.65

No. 1030. 30" blade. $7.50

30 DAY TRIAL

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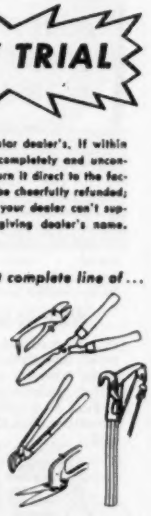

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nue Q, Lubbock, Tex., engrs.

South Dakota—Mork Hardware & Electric Co., Clarkfield, Minn., CA. $355,495, 290.52 mi. rural distr. lines, Perkins Co. Grand Electric Co-operative, Hison, S. D.

Texas—R. D. Cooper Constr. Co., Box 38A, Zachary, La. CA. $128,308, sys. imprvs., Hunt Co. Hunt-Collin Electric Co-operative, Greenville, Tex. Freese & Nichols, 407 Danciger Bldg., Fort Worth, Tex., engrs.

Tex., Houston—City, City Hall, 900 Brazos St., Houston, Tex., Own Forces. $100,000. exten. imprv. underground conduit electric fire alarm sys. L. Fugate, city engr.

Washington—Larned Constr. Co., Box 464, Moses Lake, Wash., CA. $241,783, 126.7 mi. rural distr. lines, Molson Co. Molson-Chesaw Electric Co-operative, Molson, Wash. H. A. Sewell, Nobler Bldg., Newport, Wash., engr.

Wash., Copalis—J. G. Watts Constr. Co., 3419 16 Ave. W., Seattle, Wash., CA, $3,719,000, est. $5,000,000 design, construction, installation and testing high frequency radio station for Voice of America, State Dpt., 21 St. and Virginia Ave. N.W. Wash., 25, D. C. Bids Oct. 31.

B. C., Nelson—Marwell Constr. Co., Ltd., 1500 Georgia St., Vancouver, B. C. CA, $100,000, diesel power plant, Fort Nelson, B. C. Govt. of Canada, Defence Constr. (1951) Ltd., 70 Lyon St., Ottawa, Ont. Bids Oct. 23.

B. C., Vancouver—J. H. MacRae Co. Ltd., 2210 Cambie St., Vancouver, B. C., CA $78,043, electrical distr. sys., also installing power and control cable, at R.C.A.F. Station. Govt. of Canada, Dpt. National Defence, Cartier Sq., Ottawa, Ont. Defence Constr. 1951 Ltd., 70 Lyon St., Ottawa, Ont., engr.

INDUSTRIAL COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

Conn., Hartford—Connecticut General Life Insurance Co., 55 Elm St., office bldg., Washington and Buckingham St. $2,000,000.

Ga., Brunswick—City, plans by Abreu & Robeson, Brunswick, hospital, $1,000,000.

Ga., St. Marys—St. Marys Kraft Corp., St. Marys, plant addns. $1,350,000.

Ill., Lake Zurich—School Dist. 125, Lake Zurich, plans by Burnham & Hammond, 53 W. Jackson St., Chicago, Zone 4, high school addn. $900,000.

Ill., North Chicago—School Dist. 123, 1302 Argonne Dr., plans by Warren S. Holmes, Olds Tower, Lansing, Mich., high school. $2,000,000.

Miss., Meridian—City, City Hall, mfg. plant for Textron, Inc. Approx. $3,000,000. Bill Archer, WMOX Bldg., Morris McNair, Rosenbaum Bldg., L. L. Brasfield, Kidder Bldg. and Krouse & Yarbrough, WMOX Bldg., all of Meridian, archts.

O., Toledo—Toledo Hospital, Wilson L. Benfer, supt., North Cove Blvd., 5 story Hospital addn. to be built as 2 wings, joined in form of "Y" connected with present bldg. by a tunnel. $4,500,000.

Okla., Tulsa—Tulsa Medical Center, 10 and Boulder Sts., plans by D. R. Graham, Tri-States Bldg., 12 story medical and dental bldg., 10 and Boulder Aves. $1,000,000.

S. C., Pelzer—School Bd. Dist., 20 Anderson, 107,000 sq. ft. high school. Approx. $600,000. Lyles, Bissett, Carlisle & Wolff, 1321 Bull St., Columbia, archts.

Tenn., Cleveland—John L. Hutcheson, Jr., Cleveland, plant addns. $1,000,000.

Tenn., Knoxville—Brookside Mills, Inc., 601 Baxter Ave. N. W., mill addns. $3,000,000.

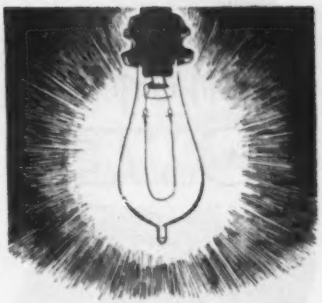
Tex., Garland — Luscombe Airplane Corp., Garland, Instruments mfg. shop bldg. $225,000; airplane manufactured parts, incl. B-36 elevators and door assemblies $275,000; general expansion and imprvs. to existing airplane parts mfg. plant, $1,000,000.

Tex., Houston—Phillips Chemical Co., subsidiary of Phillips Petroleum Bldg., c/o City National Bank Bldg., Houston, chemical plant to mfg. ammonia, methanol and a variety of other petro-chemicals. $40,000,000.

Va., Richmond—State, State Office Bldg., Richmond, plans by Merrill C. Lee, 601 E. Franklin St., state capitol bldg. addns. $875,000.

N. B., Dalhousie—Sisters of Charity of St. Joseph, Dalhousie, 5 story, brick, concrete hospital, Victoria St. $1,500,000.

Que., Montreal — Montreal Building Trades Apprentices Training Comn., 2255 Laurier Ave. E., Building Trades Training Center, Laurier Ave. E., Approx. $1,000,000.



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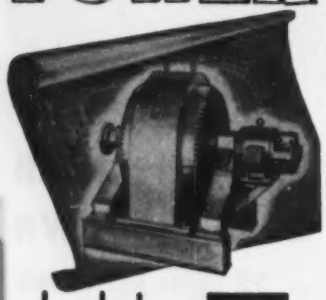

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● OIL MAINTENANCE: Bulletin 632-P has 12 pages describing and illustrating dry-type oil maintenance methods for bearings of modern turbines. The importance of continuous oil maintenance, and the factors which cause oil deterioration are fully explained by charts, diagrams and phantom views. A section covers maintenance of insulating oil dielectric in transformers, circuit breakers and switches. Bowser, Inc, Fort Wayne 2, Ind.

● PACKAGED POWER: A new 24-page bulletin, GEA-5600, outlines methods of obtaining electric power equipment for quick expansion at low cost and with a minimum of critical materials. Included are 52 photographs and diagrams. General Electric Co, Schenectady 5, N. Y.

● TUBINGS AND SLEEVINGS: Complete descriptive information and technical data on Dieflex tubings and sleevings are contained in a new 8-pg bulletin, No 250A. Dieflex products are used for insulating leads and wires in all types of electrical equipment. Classes, grades, and features of flexible tubings and sleevings are described. Insulation Manufacturers Corp, 565 W Washington Blvd, Chicago 6, Ill.

● INSTRUMENT CABINETS: Catalog 508 describes the Pacific type PH cabinets for relays and instruments. Catalog includes dimensions and cutaway sections of cabinets. Pacific Electric Mfg Corp, San Francisco 24, Calif.

● STREET LIGHTING BRACKETS: Hapco aluminum street lighting brackets are described in Hubbard's new 8-page catalog. Types of brackets described include tapered type, muncipal type, round brace type, tie-rod type mast-arm and street hood brackets. Hubbard Aluminum Products Co, 6201 Butler St, Pittsburgh, Pa.

● WIDE RANGE TACHOMETER: Technical data sheet No 42P describes a three range, single head, fixed type tachometer. A speed range of 40 to 50 to 1 can be measured by selecting one of three speed ranges. Metron Instrument Co, 432 Lincoln St, Denver 9, Col.

● CO_2 RECORDER: Publication 51-553 presents condensed information on Hays automatic CO_2 recorder. Instrument applications and a description of the Orsat principle are included with detailed drawings. Hays Corp, Michigan City, Ind.

● X-Y TYPE RECORDER: A 4-page bulletin, 330, describes Model MD-2 recorder. Instrument is a portable, self-contained microformer type which plots on rectangular coordinates any two variables. Baldwin-Lima-Hamilton Corp, Philadelphia 42, Pa.

● MANUAL STARTING SWITCH: A manual starting switch for fractional horse-power motors is discussed in bulletin 600. It presents the switch in detail and is illustrated. A key operated switch for both open and closed type enclosures is included, useful where unauthorized operation of the switch is desired. Allen-Bradley Co, Milwaukee 4, Wisc.

● VIBRATION FATIGUE TESTERS: Testers enable industry to pre-test any part or assembly, therefore knowing beforehand what weakness exist in materials. A 6-page folder describes testers completely. All American Tool and Manufacturing Co, 1014 West Fullerton, Chicago 14, Ill.

● PORTABLE PYROMETERS: Suitable for plant and lab, instruments are used for testing temperatures of molten aluminum, zinc, lead, tin, brass, and other nonferrous alloys before pouring. Specifications on thermocouple holders and tips are included. Bulletin PPY-1, Wheelco Instrument Co, 847 W. Harrison St, Chicago 7.

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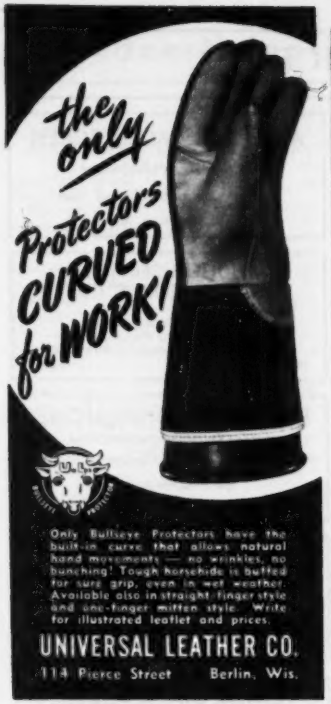
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BOOK REVIEWS

Management

Incentive Management. **By James F. Lincoln. Published by the Lincoln Electric Co. Cleveland 17, Ohio. 288 pages. Price $1.00 in USA, $1.50 elsewhere, postage prepaid.**

How people can develop as skillful individuals taking pride in the cooperative application of their respective skills towards making better products or giving better service is the concern in this book. The main spring of that development of skill is incentive, and the fundamental incentive in Lincoln's thinking is recognition of that skill and the results it achieves in higher pay, greater output and lower prices. How we can put this incentive into our business life as we do in other phases of our life, and how everyone will benefit thereby is the problem and thesis discussed.

Generation

Generating Stations. **By A. H. Lovell. Published by McGraw-Hill Book Co. Inc, New York 18, N. Y. 431 pages, illustrated. Price $6.50.**

Additions to this fifth edition comprise new data on gas turbines, improved thermal cycles, recent cost data, and details about new circuit breakers, relays, etc. The text thus continues to constitute a prime treatment of the economics and practicalities not only of generating stations but of distribution systems, interconnection, fault currents, and system protection.

Mathematics

Tensor Analysis—Theory and Applications. **By I. S. Sokolnikoff. Published by John Wiley & Sons, Inc, New York 16, N. Y. 335 pages, illustrated. Price $6.**

The subject of tensors can be abstruse to engineers familiar only with conventional college mathematics and this book by no means reduces it to the simplicity of trigonometry. However, the author has injected in the introduction enough of the essence of vectors and matrix algebra to pave the way for grasping the meaning and potentiality of tensor analysis. From there on the subject is developed on a self-contained basis so that the latter half could be devoted to the application of tensor calculus to geometry, analytical mechanics, mechanics of relativity and the mechanics of deformable media. Problems are few and essentially mathematical exercises rather than engineering applications.

Electrical Instructions

Learning Electricity and Electronics Experimentally. **Leonard R. Crow. Published by the Scientific Book Publishing Company, Vincennes, Indiana. 525 pages.**

The general subject of electricity can be made quite interesting for one who wishes to learn and master the important principles. This book, looking at these principles in our extremely simple manner, utilizes over 130 experiments and demonstrations to guide the student toward an understanding of the fundamental laws which control magnetic and electric phenomena.

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NEW ADVERTISEMENTS received by Jan. 18th in the N. Y. C. office will appear in the Jan. 28th issue subject to limitation of space available.

Corrosion Engineers

Corrosion Engineers with minimum of three or four years experience in corrosion investigations and design of cathodic protection on pipe lines and lead cables in country and city networks. Must be graduate electrical engineer (or equivalent). Work involves extensive travel, with headquarters in New York City. Only applicants with above qualifications will be considered. Give full details of education and experience, and references, in application.

P-2344, Electrical World
330 W. 42 St., New York 18, N. Y.

WANTED: Experienced Power Station Engineer.
POSITION: Assistant to Manager of Power Production with administrative responsibility of operating central stations totaling approximately 300,000 kw.
LOCATION: Pennsylvania.
ADVANCEMENT: Excellent for growth on job and promotion in near future.
EXPERIENCE: 10 years minimum, with at least 5 years in operation, maintenance or efficiency work in large modern steam-electric central station. Construction and design experience will be considered.
EDUCATION: B.S. degree in Mechanical (preferred) or Electrical Engineering from an accredited engineering college.
AGE: 35-45.
Salary commensurate with qualifications
All applications will be acknowledged. Please send personal record to

P-2130, Electrical World
330 W. 42 St., New York 18, N. Y.

LIGHTING ENGINEER

Experienced lighting engineer, capable design, selection and application of lighting for generating plants, electric substations, industrial plants and office buildings. Applicant should be qualified or interested in training for handling of all technical problems related to lighting engineering. Location, New York City. Please furnish complete information including age, education and experience record.

P-2353, Electrical World
330 W. 42 St., New York 18, N. Y.

ELECTRICAL FIELD ENGINEERS

Experienced in Construction of Power Stations and High Voltage Substations required by established consulting engineers. Location—Middle West.

P-2904, Electrical World
520 No. Michigan Ave., Chicago, Ill.

ELECTRICAL ENGINEER

Required by well known Consulting Firm for Design of Power Stations and Substations. Familiarity with control board and relay applications desirable. Good opportunity for graduate with 5 to 10 years experience.

LOCATION - CHICAGO

P-2905, Electrical World
520 No. Michigan Ave., Chicago 11, Ill.

WANTED

SALESMAN or AGENCY

Experienced in sale of power and distribution transformers for Chicago district

SW-1778, Electrical World
330 W. 42 St., New York 18, N. Y.

ELECTRICAL ENGINEER

An Assistant Superintendent for Midwest Municipal electric and water utility. Experience in design, planning and operation of 2400/4160 volt distribution systems. Knowledge and experience in steam generating plants desirable. Age 32-40 years.

P-2861, Electrical World
330 W. 42nd St., New York 18, N. Y.

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (18)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

ELECTRICAL ENGINEER—Position open in Eastern United States for young man with actual experience in distribution and electrical maintenance work. Take off and estimating experience helpful. Excellent opportunity for advancement. This position is permanent. Send record of experience and education and references with application. Salary open. P-2910, Electrical World.

MANAGER, COMBINATION Utility — predominantly electric, administrative and sales ability important, technical background desirable. Permanent position and substantial opportunity for qualified person. Replies confidential. Submit complete details including salary requirements. P-2466, Electrical World.

EMPLOYMENT SERVICE

SALARIED POSITIONS $3,500 to $35,000. We offer the original personal employment service (established 42 years). Procedure of highest ethical standards is individualized to your personal requirements. Identity covered, present position protected. Ask for particulars. R. W. Bixby, Inc., 262 Dun Bldg., Buffalo 2, N. Y.

SALARIED PERSONNEL $3,000-$25,000. This confidential service, established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. L, 241 Orange St., New Haven, Conn.

U. S. Government

UNITED STATES DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Sealed Bids (Invitation No. DS-3617) will be received by the Bureau of Reclamation, Denver, Colorado, until February 5, 1952, and then publicly opened for furnishing one 30,000-kva, 13,800-volt, 3-phase, 60-cycle, hydrogen-cooled, outdoor-type synchronous condenser with control equipment for Gering substation, Transmission Division, Nebraska, Missouri River Basin Project. Delivery is desired within 360 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver, Colorado.

U. S. Government

UNITED STATES DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Sealed Bids (Invitation No. DS-3616) will be received by the Bureau of Reclamation, Denver, Colorado, until February 5, 1952, and then publicly opened for furnishing generator-voltage switchgear assemblies; distribution transformer; and generator-neutral grounding equipment for Canyon Ferry Power Plant, Missouri River Basin Project. Delivery is desired within 500 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver, Colorado.

WANTED

WANTED

Two (2)—Motors, T.E.F.C., 2300 V., 200 H.P., 1750 R.P.M.

W-2917, Electrical World
330 W. 42 St., New York 18, N. Y.

COPPER CABLE WANTED

2500 feet, 600 volt, 300 MCM—RH-RW Cable.

W-2950, Electrical World
330 W. 42 Street, New York, N. Y.

What is YOUR Problem?

Competent men for your staff? Employment?
Or, are you looking for — or offering — a business opportunity of special interest to men in the industry served by this publication?
The solution of any of these problems can logically be found *first* among other readers of Electrical World. You can get their attention—at small cost—through an advertisement in the Searchlight Section of

ELECTRICAL WORLD

SUBSTATION EQUIPMENT

TRANSFORMERS

Qu.	KVA	MFR.	VOLTAGE
3	3333	West.	132000—7620/13200 Y
3	1000	Wag.	69000—7200/12470
4	2500	West.	44000—11000
2	1500	Wag.	44000—6600 NEW
3	2000	Mel.	44000/22000—440/230
3	100	G. E.	44000—2300
3	75	West.	44000—7200/12470 Y
1	8333	West.	13800—2300
1	18750	A.B.B.	34840—11000, 3 ph.
6	1500	Pitts.	33000—2400
3	200	West.	33000—2400
4	150	G. E.	33000—7200/12470 Y
3	100	A. C.	33000—7200/12470 Y
3	75	Wag.	33000—7200/12470 Y
3	50	G. E.	33000—2300/4000 Y
3	50	Kuhl.	33000—7200/12470 Y
4	450	A. C.	23410/44000—13280/23000
9	50	G. E.	22000—2300/4600
3	37½	G. E.	22000—6900
6	25	G. E.	22000—6900
2	667	Pitts.	18300—2300
3	200	Mel.	11000—2300
3	667	Kuhl.	7200/12470 Y—2400
3	100	West.	7200/12470 Y—2400
4	50	G. E.	7200/12470 Y—2300
3	150	Wag.	6900—2300
1	100	G. E.	2300—575, 3 ph.
1	37½	G. E.	230/460—115/230

INDUCT. REGULATORS—OUTDOOR

1—140 KVA G. E. 200 A. 4000 V. 3 ph.
2—46 KVA West. 200/4000 A. 2300 V.
6—36 KVA G. E. 150/300 A. 2400 V.
2—36 KVA G. E. 75/150 A. 4800 V.

CIRCUIT BREAKERS

1— 600 A. 73 KV G. E. FHKO-236-500 MVA
2— 400 A. 37 KV G. E. FHKO-236-500 MVA
1—1200 A. 15 KV G. E. FKO-139-350 MVA
1— 600 A. 15 KV G. E. FKO-139-350 MVA
2— 600 A. 15 KV G. E. FHKO-136-1328 BS
1— 400 A. 15 KV G. E. FKO-37-40
4— 600 A. 15 KV G. E. FHKO-139-750 MVA

BREW, WOLTMAN & CO., INC.
52 Church St. New York 7, N. Y.

Seven (7) New Motors

150 H.P., 1180 R.P.M., 220/440 volt, 3 ph. 60 cycle—designed for 30° angle operation. Can be converted to horizontal.

FS-2930, Electrical World
330 West 42nd Street, New York 36, N. Y.

FOR SALE

3—New 3 Hp, 1 phase, 60 cycle 110/220 volt, type WZS, Splashproof, 1200 rpm, repulsion start induction run, Fairbanks Morse Electric Motor. Price each $283.80 Fob. Carmi, Ill.

3—New 5 Hp, 1 phase, 60 cycle 110/220 volt, type WZS, 1800 rpm, Splashproof, Repulsion start, induction run Fairbanks Morse Elec. Motors. Price each $235.80 Fob. Carmi, Ill.

Contact:

TERLEX CO., INC.
BOX 207 CARMI, ILL.

WORLD'S LARGEST INVENTORY

FREE CATALOG

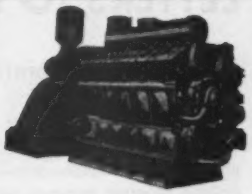
MOTORS—GENERATORS—TRANSFORMERS
New and Guaranteed Rebuilt
1 H.P. to 2500 H.P.

ELECTRIC EQUIPMENT CO.
P. O. BOX 51, ROCHESTER 1, N.Y.

Buying
Good USED Equipment
is frequently the difference between having needed equipment or doing without it.

DIESEL POWER

FOR
IMMEDIATE SHIPMENT
UNIT CAPACITIES—10 TO 1875 KVA
A.C.—50 AND 60 CYCLES
VARIOUS VOLTAGES



A PARTIAL LISTING OF OUR INVENTORY

KVA	Make	Model	HP	RPM	KVA	Make	Model	HP	RPM
1875	Fairbanks Morse	32F16	2600	300	375	Enterprise	DSC-6	450	450
1500	Fairbanks Morse	38D8½	1800	720	300	Superior	KNA	398	514
1250	General Motors	16-278A	1600	720	313	General Motors	6-268A	420	1200
1187.5	General Motors	12-567	1200	720	313	Clark	MD-4	420	1200
625	Alco	6-12½x13T	750	600	138	Ingersoll Rand	S	225	514
425	Baldwin	VO-6	510	450	187	General Motors	3-268A	140	1200
400	Busbyrus	80	480	600	75	General Motors	6043C	85	1800

D.C. UNITS ALSO AVAILABLE

A. G. SCHOONMAKER COMPANY, INC.
ENGINE DIVISION, 50 CHURCH ST., NEW YORK 7, N. Y.

FROM AVAILABLE STOCK

TURBO GENERATORS

Qu	KW	Make	Desc.
1	6000	Al. Ch.	Condensing 200/250 I.S.P. 2300 v. 3/60 Exc. & Surface Cond.
2	750	G.E.	Condensing — 425 lbs. 750 TT. I.S.P. 440v. 3 ph. 60 cy.—Built 1944
1	600	Moore	Non-condensing 150/300 lbs ISP 3/35 lbs. G.B.P. 3/80/480 volts Direct Connected Exciter
1	400	Westg.	Non-condensing — 125/150 lbs. I.S.P. 8/10 lbs. B.P.—240/480 v. 3 ph. 60 cy.
1	300	G.E.	Non-condensing 150/175 I.S.P. 5/10 B.P.— 480 v. 3 ph. 60 cy.

SYNCHRONOUS CONDENSERS

	KVA	Make	Type	Volts	Speed
1—	8000	Whse.		2400/4160	600

MOTOR GENERATOR SETS
3 ph. 60 cy.

Qu	KW	Make	Speed	DC Volts	AC Volts
2—	2000	G.E.	600	664 25 cy.	11000
1—	1500	G.E.	720	600	2300
1—	1500	G.E.	360	275	2300/4600
1—	1000	G.E.	900	280	4160/6900
2—	500	Whse.	900	250	6600/13200
1—	300	Whse.	1200	125/250	2300
1—	300	Whse.	900	250	440
1—	300	G.E.	720	125	2300
1—	400	G.E.	720	250	440/2300
1—	350	G.E.	900	125	4160
1—	240	G.E.	1200	250	2300
1—	160	G.E.	1200	275	2300
1—	150	Whse.	1200	275	2300
1—	140	Cr. Wh.	690	125/250	2300

TRANSFORMERS—60 Cycle

	KVA	Make	Type	Ph	Voltages
1—	4000	G.E.	HT	3	22000x2300
3—	1500	Pitts.	OISC	1	22000/2300
3—	1250	G.E.	HVDDJ	1	6600x550
3—	500	A.C.	OISC	1	13200/2300
6—	300	G.E.	HT	3	2400x240/480

BELYEA COMPANY, INC.

OFFICE & SHOP
51 Howell St., Jersey City 6, N. J.

—TRANSFORMERS—

BOUGHT AND SOLD

We carry a large stock of transformers, and invite your inquiries. New Transformers built to your specifications.

PIONEER TRANSFORMER REBUILDERS

We rewind, repair and redesign all makes and sizes.
One Year Guarantee.

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
SINCE 1912 CINCINNATI 27, OHIO

J. L. HEMPHILL & CO.

ELECTRICAL ENGINEERS & EQUIPMENT

TRANSFORMERS

1—1500 KVA Whse., 3 Ph., 33,000/66,000-240/480V, HT taps.
1—1500 KVA G.E., 3 Ph., 4150V, 2300V Pyranol
1— 400 KVA G.E., 1 Ph., 6900V 2300V Sec.
1— 200 KVA G.E., 3 Ph., 2400-220 Sec.
3— 100 KVA Wagner, 1 Ph., 2400V pri., 120V sec.
1— 100 KVA Newark, 440V 3 Ph., 220V 2 Ph.
1— 50 KVA G.E., 1 Ph., 13,450V, 120/240 Sec.
2—37½ KVA Allis, Air, 1 Ph., 480V pri., 120V sec.
1— 25 KVA G.E., 1 Ph., 11,500V pri., 230/460V sec.

SYNCHRONOUS MOTORS

1— 300H.P. Elec. Mach. 720 RPM. 3 Phase 60 cyc., 2200V. Totally Enclosed Fan Cooled Outdoor service.

MOTOR GENERATOR SETS

1—1000 KW G.E., 600 V. 514 RPM, 4000V Syn.
1— 200 KW Whse., 275V, 900 R.P.M., 220 V. Syn.
1— 175 KVA West., 1 Ph., 220V. Motor 3 Ph., 440V.
1— 150 KW G.E., 125/250V, 1200 RPM, 2300 Syn.
1— 75 KW Crocker Wheeler, 250V, 1200 RPM, 2300/4150V Syn.

SLIP RING MOTORS

1—2500 HP G.E., 600 V. 257 RPM, 6600V.
1— 250 HP West., CW, 600 RPM, 440V.

SYNCHRONOUS CONDENSER

1—2500 KVA Whse., 720 RPM, 2200V with D.C. EXC.

Large Stock of A.C. and D.C. Equipment

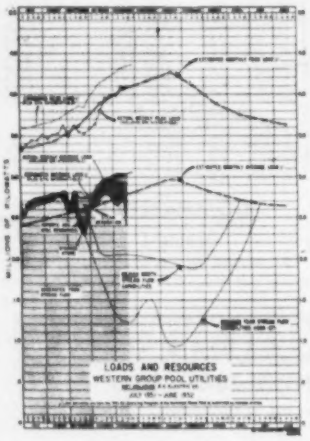
LETTERS TO THE EDITOR

1951 The Low Point?

To the Editor:

We are hopeful that 1951 marked the low point in our resources vs supply situation in the Northwest. If the Federal program proceeds reasonably as planned, the situation definitely will be improved by 1953, even considering the aluminum expansion now proposed. Approval by FPC of a license for Tacoma's Cowlitz Project will help ease the situation. Tacoma has some hopes of getting some of the generation completed in time for the winter peak of 1953.

In general, I agree with the Secretary of the Interior that defense loads, particularly aluminum, should be allocated to hydro areas to the extent that full service could be rendered under median water conditions. The



BPA's Weekly Stream Flow Data

load depending on median water conditions, as distinguished from critical water conditions, should be on an interruptible basis. Such interruptible loads could be served on the average about 70 to 75% of the time.

It seems to me a sound policy to put in a somewhat larger installation of aluminum reduction facilities for 70 to 75% use of hydro, which would otherwise be wasted, rather than to put in somewhat smaller amount of reduction capacity which would require continuous use of gas or other exhaustible fuel.

If the program is scheduled on the basis of 70 to 75% operation, then some curtailment would be anticipated and scheduled. In the case of extreme emergency, additional production would be possible by curtailment of other, at that time less essential, uses.

Last fall, except for periods in September and November, water conditions were exceptionally good, so that it was possible to serve all of our interruptible loads with only a very minor amount of curtailment for two weeks in September. The season is still not very advanced and although conditions in December were extremely good, we are not in the clear throughout the season.

Enclosed is a chart which covers the load and resource situation in the Northwest. It is brought up to date weekly by us. It shows that total stream flows during the middle and latter part of September were heading sharply downward at a level below critical. Since then stream flows have been far in excess of critical but in November stream flows were heading very sharply downward again. In December we had extensive rains and succeeding charts will show reversal upward.

Wm. A. Dittmar
Power Manager
Bonneville Power Administration
Portland, Oregon

A Slip of the Pen

To the Editor:

We beg to call your attention to an apparent error in the figures contained in the opening paragraph of your editorial on page 87 of the December 3rd issue.

We started to quote from this article. However, when we did some figuring we found that one statement does not seem to stand analysis. According to our calculations, it would be necessary to use 1.968 kwhr per man hour in industry and commerce (instead of 1.85) if "11 times greater" consumption was registered, as compared with farm usage.

Fortunately, probably few of your readers will detect this error, which is very easy to make. The small miscalculation detracts little from the general excellence of the editorial.

Please accept my compliments with regard to this "special report" issue. It contains a wealth of information. How you editors are able to compile and publish so much data and information with so few "slips," is certainly amazing.

P. P. Pine
Engineer-in-Charge of Power Sales
San Diego Gas & Electric Co
San Diego 12, Calif.

• If the phrase had read "11 times as much" instead of "11 times greater," Reader Pine would have found no error. For this lesson in exactitude of phrasing we thank him.

Farm Market Survey

To the Editor:

The story about the future farm market on p 103-118 of the December 3 issue of Electrical World merits a blue ribbon. I can appreciate what it takes to gather material for such a fine editorial job. Naturally, I would like to have seen a few pictures taken in Minnesota.

At our Minnesota Electric Farm Exhibit at the State Fair we prepared ten panels of pictures taken on electrified farms and they proved to be as interesting to the crowds as any of the exhibits. If at any time in the future you prepare any copy on the farm market and want some pictures, please drop me a line.

A. H. Kessler
Executive Secretary
North Central Electrical Industries
Minneapolis 2, Minn.

• Next time we'll use some pictures from Minnesota.

Neilsen Method

To the Editor:

In the December 10, 1951 issue, page 3, you mention the Neilsen back-pressure-arm-lift method of resuscitation. We are interested in this method for our students. Could you tell me where I can obtain a description of the method?

W. W. Lewis
Professor of Electrical Engineering
Union College
Schenectady, N. Y.

• Write to the National Headquarters of the American Red Cross at Washington, D. C.

High Standard Performance

IS BASED ON SOUND DESIGN

ALLIS-CHALMERS NETWORK transformers have met the highest standards of network systems for over 24 years. That statement is backed up by the men who specify and buy network transformers on the nation's great utility systems.

To simplify your application problems, Allis-Chalmers builds all three basic types: oil filled, *Chlorextol* liquid filled and new sealed dry type. Network transformers totaling over 1¼ million kva are now installed.

For more information contact your nearby A-C sales office or write to Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 61B6152A.

A-3569

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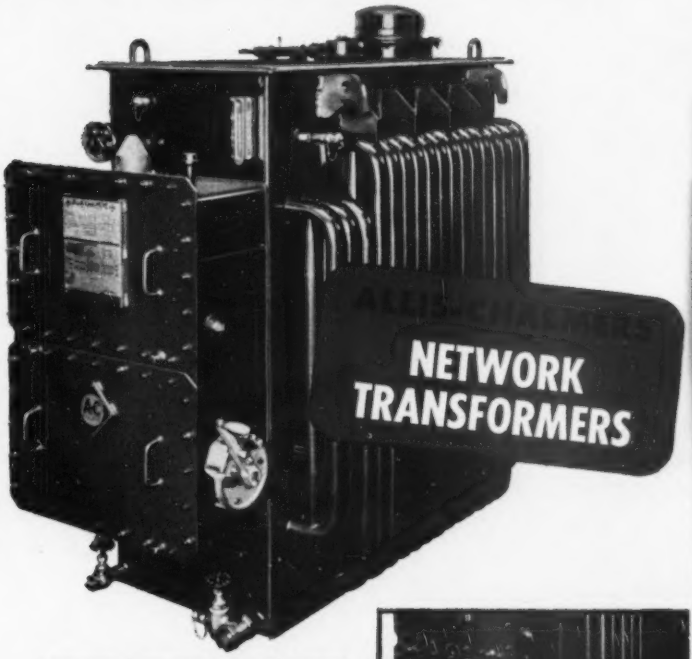
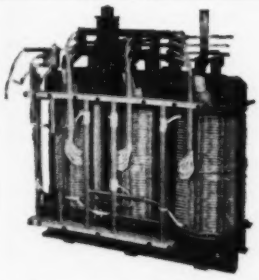




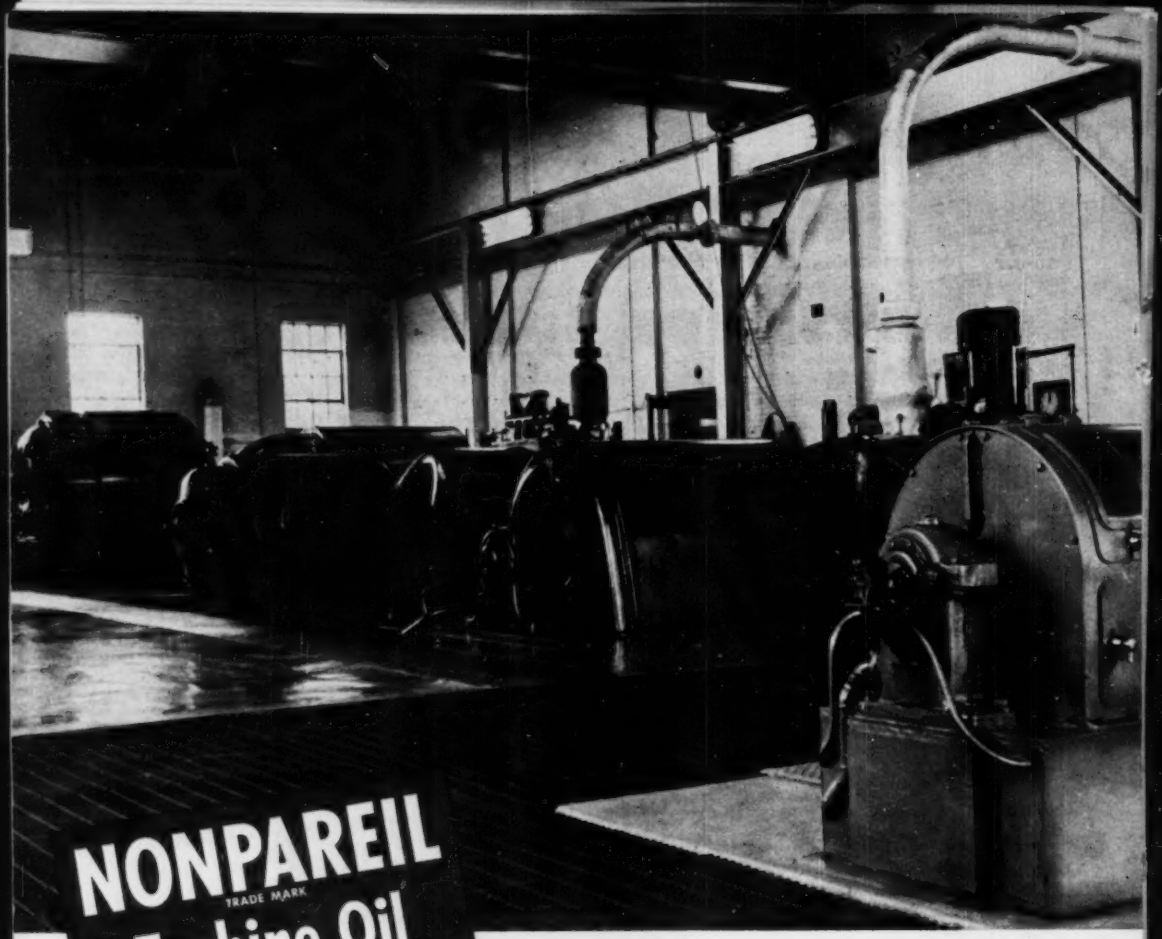
1. Compact low-loss design. Thermal capacities are high even for severe load conditions. Sturdy, time-proven core and coil construction meets repeated short-circuit stresses of network operation.

2. A safe, dependable no-load tap-changing mechanism engages all three phases at once. Handle inserted through 2-inch opening in the cover operates the tap-changing mechanism and cannot be removed unless it is in positive tap position. Cover entrance eliminates packing gland maintenance.

3. Welded main cover and switch compartment help eliminate gasket maintenance. Shot-blast cleaning, three coats of baked-on phenolic base paint formulated for high water resistance, and compound treatment of base areas give superior surface protection.

ALLIS-CHALMERS

Network Transformers—Over 1,000,000 KVA Installed



NONPAREIL
TRADE MARK
Turbine Oil

Completes first 20 years on this job

AFTER TWENTY YEARS of service in the first turbine installed by a midwest power plant, the original fill of NONPAREIL Turbine Oil is still on the job. There's no retirement in sight for this veteran.

During this time the acidity number has never exceeded 0.10 mg. KOH/gm. Removal of the oil for treating or for cleaning of the turbine lubricating system has never been necessary, and make-up requirements have remained at a minimum. That's low-cost, trouble-free turbine lubrication . . . the same kind of lubrication these plant operators are getting in three newer turbines with NONPAREIL.

There's no time limit on results like these when you use NONPAREIL. It's guaranteed in writing to last as long as the turbine itself, and the neutralization number is guaranteed never to exceed 0.15 mg. KOH/gm. For low-cost, trouble-free lubrication of *your* turbine, ask your Standard Oil lubrication specialist to explain the advantages of NONPAREIL. Let him show you operating records covering periods of continuous service well over twenty years. Call your nearest Standard Oil Company office. Or write: Standard Oil Company (Indiana), 910 South Michigan Ave., Chicago 80, Ill.

STANDARD OIL COMPANY STANDARD *(Indiana)*